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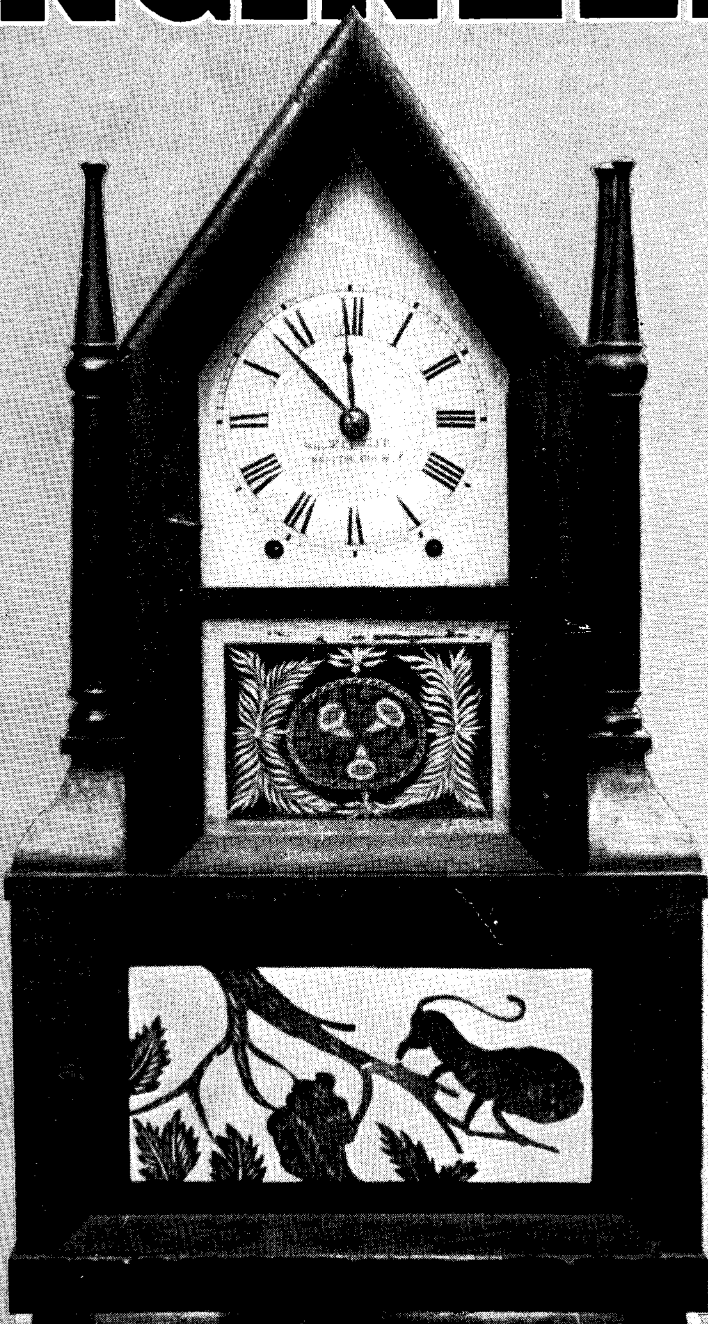
THE MODEL ENGINEER



The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

7TH FEBRUARY 1952 VOL. 106 NO. 2646

SMOKE RINGS

The Scope of the " M.E."

● A FEW of our readers are occasionally inclined to criticise articles on subjects which they consider to be " outside the scope of model engineering." This raises the very old and vexed question of defining the word " model " in exact terms—a task which has often defeated the best lexicographers. Model engineering is a hobby which cannot be neatly pigeonholed, tied up with a ribbon, or sealed in a watertight compartment. By its very nature, it calls for a very wide versatility, both of thought and practice, and to cater adequately for its devotees, a journal devoted to it must necessarily cover a very wide field. But this does not mean that the model engineer must be a jack-of-all-trades, dabbling in every craft and mastering none ; any subject tackled must be dealt with in a thorough and practical manner. In selecting the subject-matter of THE MODEL ENGINEER, we endeavour always to satisfy the requirements of the largest possible proportion of our readers, always bearing in mind that any information which tends to promote engineering knowledge and craftsmanship is applicable to " true " model engineering, whether it refers to the construction of a miniature locomotive, a drilling machine, a clock, or a camera. Generally speaking, we avoid encroaching on fields which are adequately covered by specialist technical journals, though aspects of these subjects which particularly concern the amateur craftsman, or deal with interesting workshop processes, are not excluded.

Most of our readers fully realise that as model engineering technique advances, there is not only scope for improvement in existing methods of building models, but also a need to explore a wider and still wider range of objects for construction in the model workshop. Some of our readers who have objected to this broadening of the horizon have been mainly concerned with the possibility that it may lead to a neglect of the particular branch of model work in which they are interested ; but we assure them that the old and well-tried types of models will in no circumstances be neglected or allowed to fall into obsolescence.

The " Britannias " at Work Again

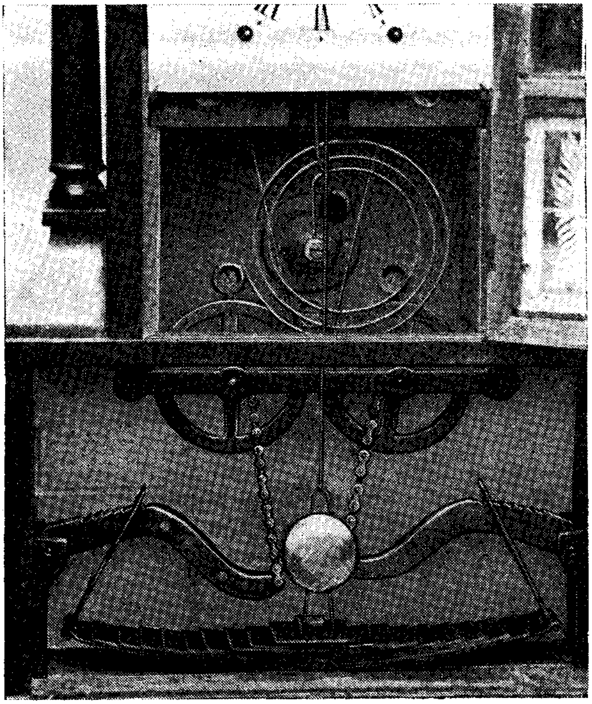
● ON DECEMBER 10TH, 1951, Class 7 Pacific locomotive No. 70004, *William Shakespeare*, recommenced working the " Golden Arrow " all-Pullman Continental express between London and Dover. Since that date, the other 24 engines of the class have again taken up their duties, though subject to a certain amount of re-allocation among the various regions of British Railways. *William Shakespeare*, for example, has now been transferred from the Southern to the Western region, and one or two other " general post " movements with regard to the other engines have been noted.

Up to the time of writing, the engines seem to have settled down once again to doing good work, and the causes of the mishaps which some of them suffered seem to have been removed.

Incidentally, the first of the Class 6 Pacifics, which are similar to the Class 7 engines but have rather smaller and lighter boilers, is in traffic in Scotland and, according to present reports doing well.

Our Cover Picture

● ON FIRST inspection, the clock illustrated here appears to be nothing more or less than a typical, and not strikingly handsome, example of the cheap domestic clocks which were manufactured, in large quantities, principally in America, but also on the Continent, and to a lesser extent in this country about 100 years ago. As a matter of fact, the main part of the movement, including the going and striking train, dial work, gong, etc., are of a standard American eight-day type, but the interesting, and in our experience, unique feature of the clock, is the fact that it is driven, not by the conventional form of mainspring or weights, but by a double-ended laminated flat spring, or " carriage " spring, anchored by its centre to the bottom of the clock case, and linked at the two ends to curved levers which, in turn, are connected at their extremities to the barrels from which the weights would normally be hung. The levers are so designed as to minimise the variation of effort applied to the train as the clock runs down, and the linkage may be varied to alter the leverage if required. By the addition of this mechanism, a weight-driven clock could be converted quite easily to spring drive. This is the first time we have actually seen a clock of this type, though we are informed that quite a number of them were manufactured, and we thought the mechanism was sufficiently interesting to bring to the notice of our readers. We are indebted to Mr. C. Bradshaw, of Chelsea, for showing us the clock and giving facilities for photographing it.



Mr. S. J. Ward

● WE REGRET to learn of the recent sudden death of Councillor S. J. Ward, of Northampton, who was, as most of our readers are aware, an expert model maker. He was president of the Northampton Society of Model Engineers, and his practical work must have been an ever-present inspiration to the members of that society who have lost a respected leader and colleague

Most of Mr. Ward's models have been illustrated in THE MODEL ENGINEER, and some of them have been seen and have won high awards at the " M.E." Exhibition in the years before the war. The models are displayed in the entrance hall of the Northampton College of Technology : they include the magnificent quadruple expansion marine engine, a Craven crane, both to 1-in. scale, and the 5-in. gauge L.M.S. *Royal Scot*, *Duchess of Buccleugh* and L.N.W.R. *Cornwall*. A later model, not quite finished, is a 5-in. gauge replica of the *Rocket*, and we hope that somebody will undertake to finish this one in the characteristic " Ward " style. All these are a fitting memorial to an outstanding model engineer.

The Vertical-boilered Road Roller

● MR. A. C. V. KENDALL, of Salisbury, Wilts, writes, in a letter recently to hand :

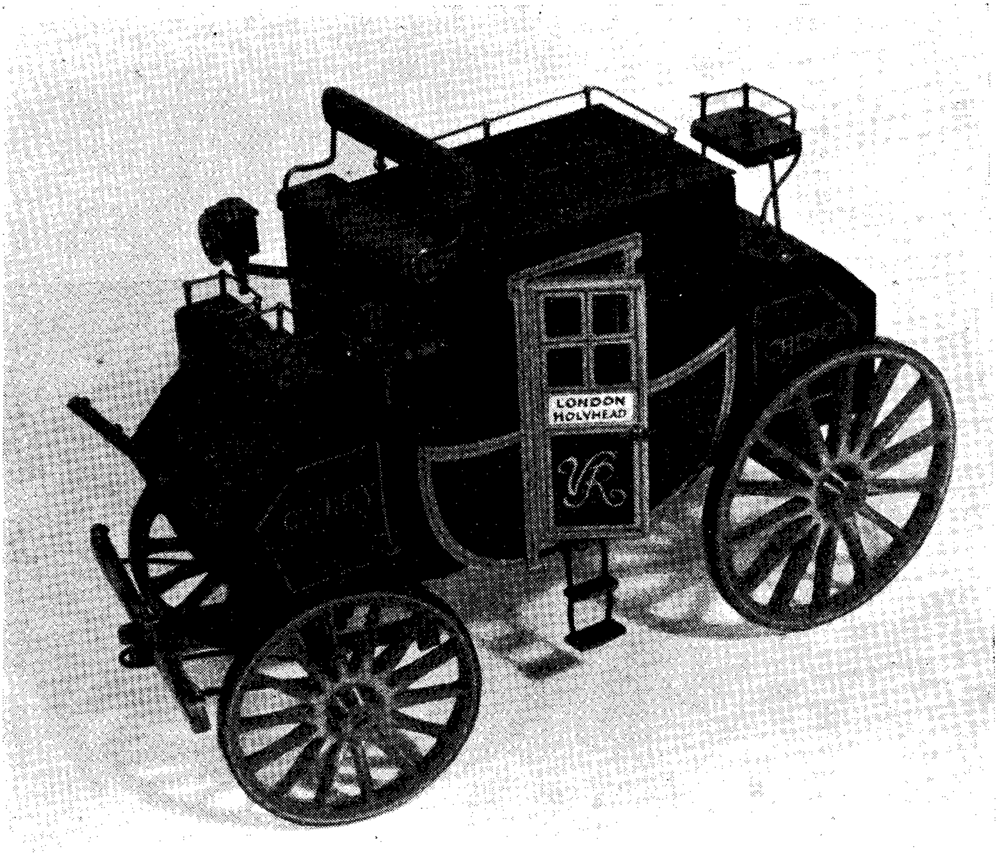
" A few miles from here, I have come across one of those little steam rollers having a vertical boiler and a second roller in place of the usual hind wheels. Some twenty-five years ago, when one of Salisbury's thoroughfares was being resurfaced, I used to absent myself from school in order to spend the day watching one of these rollers at work. I remember being impressed with its rapid reversal ; when it came to the end of its travel in one direction, it seemed not to pause at all before it was off again in the opposite direction. I have never again seen one of these rollers until I came upon the one just mentioned, in the corner of a yard on the outskirts of Wilton.

" I have often wondered about these rollers ; who made them ? Why did not one see more of them ? Was their use, perhaps, too limited to warrant their expense ? I had half hoped to see some reference to them in Mr. Hughes's wonderful book on traction engines. Perhaps they were a failure and so he left them out ? "

This type of roller was the subject of a " Smoke Ring," with photograph, in our issue for November 24th, 1949 ; and a further " Smoke Ring," January 26th, 1950, as well as letters published between January 5th and February 23rd, 1950. Aveling & Porter, of Rochester, were the designers and builders, about 1900 ; the type, which had especially rapid reversing arrangements, was originally used exclusively for rolling bitumen road surfaces.

A Model Stage Coach

by F. Mitchell



As an art and craft project relating to the Festival of Britain activities in the school, in which I am the art master, I decided to produce a display showing modes of transport by land, sea and air from 1851 to 1951.

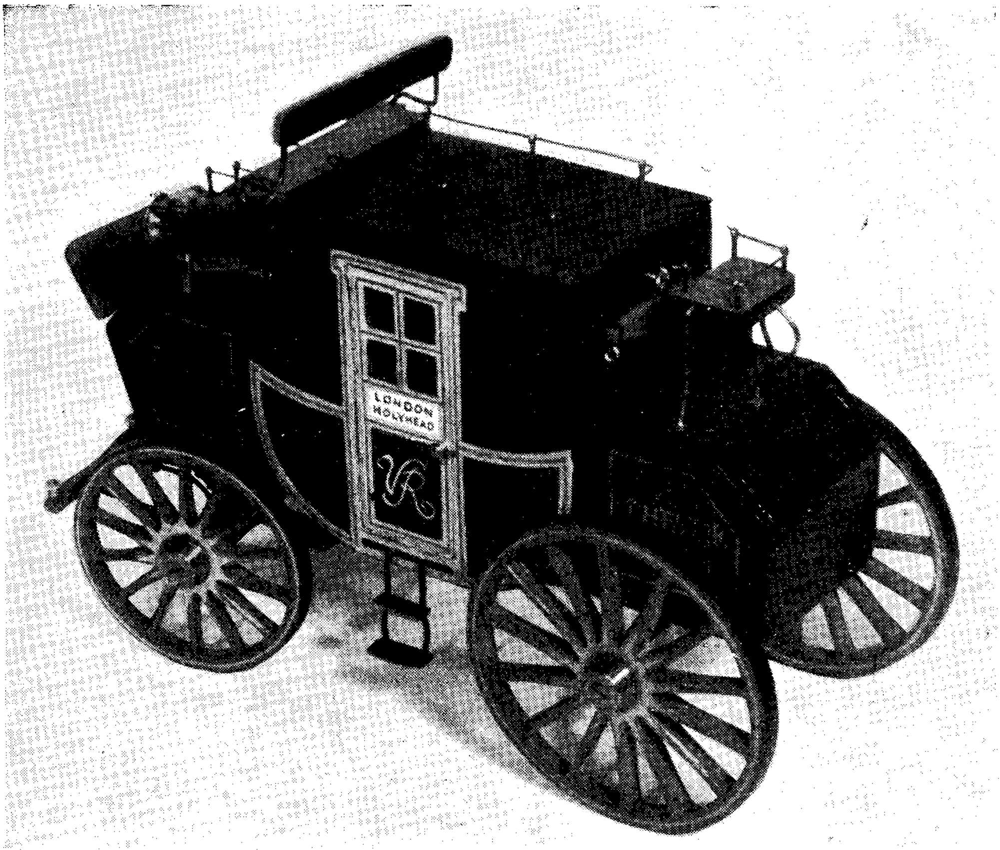
The models used included a balloon and a modern flying boat in the air, and two sailing ships and a steamship on the sea. Land transport was represented by " OO " gauge electric railways, modern motor driven road traffic, and for road transport of yesterday, I decided to build a model stage coach.

I managed to get some excellent full-size working drawings and the job was carried out in $\frac{3}{16}$-in. and $\frac{1}{8}$-in. plywood mainly, with a few modifications.

To make the model smooth running, the wheels were fitted with brass hubs which were a light press fit into the wheel centres. The pivoting front axle was also bushed with brass tube. Other brass components are the two lamps with their brackets. These were made from odd bits of rod, strips and square sectioned material plus two large brass eyelets to form the circular lamp rims. The steps are brass strip and wire.

Stanchions holding the luggage rail on the roof and rails on the seats are $\frac{3}{4}$ in. $\times$ $\frac{1}{16}$ in. split pins, whilst the rails themselves are $\frac{1}{16}$-in. brass wire.

I wanted the two doors to open so that the inside could be inspected, but I was puzzled at first about the hinges. Any hinges available were, of course, far too large for the small doors and the fitting of metal ones which I might make myself would be very difficult. It then occurred to me that the " hinges " of books made at school are strong ; and a bookcloth hinge might be the



An " aerial " and three-quarter rear view of the model stage coach

ideal solution to the door problem. A narrow strip of good bookcloth was, therefore, cut and folded and glued to the edge of each door. When this was dry, the other leaf of the cloth was glued and the door pushed into its opening. These hinges, which run the whole length of the door, are strong and almost imperceptible. $\frac{1}{8}$-in. Perspex was used to glaze the door windows.

The model was painted and lettered with good quality designer's colour which is superior to poster colour, and when dry, a protective coat, or two of clear cellulose lacquer was applied. Its colours are black, red, maroon, yellow and white.

Measuring 7 in. high by 10 in. long, the model is a correct representation of a type of vehicle the design of which changed very little over a century.

Far from Comfortable

The stage coach, with some of its passengers perched precariously on the roof, as it ploughs along a snowbound road is a favourite subject for Christmas card illustration. It will, no doubt, have occurred to many people that although very picturesque, to travel long distances high on top of a rocking coach without protection from cold and rain, must have been far from comfortable. The public's preference for these types of vehicles rather than ones which carried all their passengers inside and which were often available is yet another example of the peculiarity of human nature.

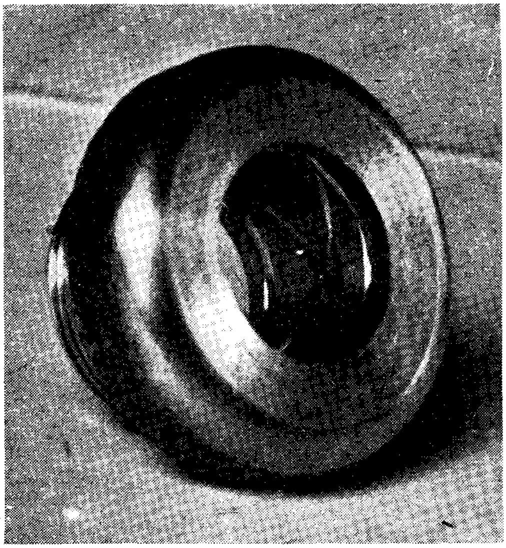
Rich and Poor

The popular stage coach was actually a close copy of the graceful carriages used by the " Quality " or aristocracy, and the poorer travellers felt much more dignified in or on them, being quite willing to endure discomfort rather than travel in coaches specially designed for the transport of common people. To make the business pay, the owners were, therefore, obliged to crowd as many people as possible inside and put seats on the roof to carry more. This period of history is known as " The Age of Reason " !

The tradition was carried on even into the 20th century when the early motor buses and tramcars had uncovered top decks.

Cross Oil-Grooving a Bush

by W. D. Arnot



A cross-grooved ¾-in. bronze bush

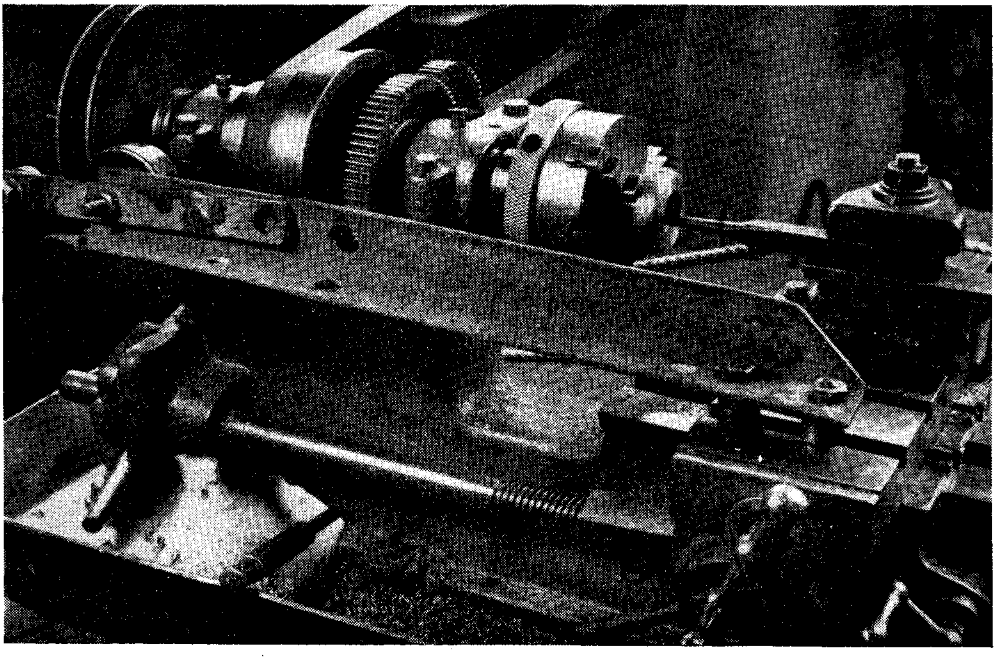
NOT many of us are equipped to cut cross oil-grooves in a bush. Being faced with the need, and not having any means of carrying out this operation, a rummage around for "scrap box inspiration" was resorted to. What was wanted, said the obvious, was a wabble plate for the tail-end of the lathe spindle, linked to a bar to push the saddle about.

By that process, which cannot be defined, the scrap agitated the inspiration, and bits and pieces were soon lying about for tentative use. Some received favour, others rejection as too cumbersome. The successful candidates are shown in the photograph.

The lathe was an old 3-in. Myford having a plain flatted mandrel end ⅝ in. diameter. The selected old vee-groove belt pulley that was to wabble had an $\frac{11}{16}$ in. bore and was secured by a single grub-screw. The throw required was about $\frac{9}{16}$ in. and a trial positioning showed that this pulley would just about do it. Now, should a skew-bored bush be made, or should a risk be taken? I plumped for the risk. Strip metal made two wedges fitted either face of the pulley and driven up tight at opposite diameters in the bore; the grub-screw bearing on one of them completed the wabble plate—and it was remarkably secure.

Now for the saddle link; what better than a piece of angle-iron? It is stiff, it lends itself to easy attachment. And the cam roller! Well, there's that old roller-skate wheel; what better?

(Continued on page 177)



PETROL ENGINE TOPICS

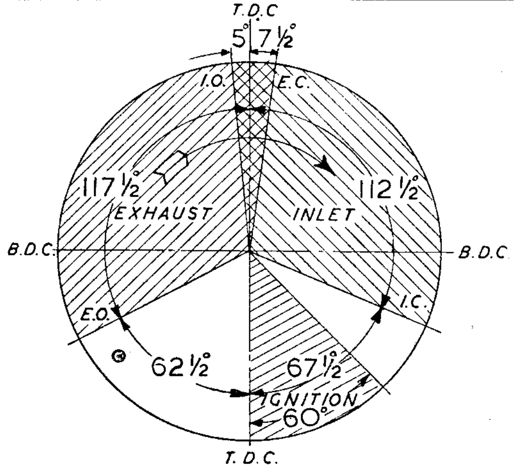
*"New Engines for Old!"

How an Ancient Gas Engine was Improved, Modernised, and Given a New Lease of Life

by Edgar T. Westbury

THE process of producing cams for i.c. engines has been described several times in past issues of THE MODEL ENGINEER, and the methods now to be described are identical in principle, if not in detail, with those which have been used for producing the cams for at least three of my previous engines. In case I should be accused of vain repetition, however, in giving details of these methods again, I may say that readers are constantly asking for more information on this subject, and it is not sufficient to refer them to articles already published.

When I described the construction of the "Seagull" 10-c.c. twin-cylinder engine some time ago, I did not give the full details of machining the cams but stated that the procedure was the same as that adopted for the "Seal" 15-c.c. four-cylinder engine, previously dealt with. As a result, I had to deal with a flood of queries, and had to go into minute details of the methods, not once, but over a dozen times!



Timing diagram in terms of camshaft angles

Those of my readers who are sticklers for "correct" practice may object that the form of cam which I have adopted for this engine does not conform with that most commonly employed in stationary gas engines. It may be mentioned that the exacting conditions encountered in modern high-speed engines call for the most meticulous care and precision in cam design, which is quite unnecessary in stationary engines running at relatively low speeds and developing only a modest volumetric efficiency. In the majority of such engines, the cams were of the "tangential" type, which means to say that the flanks formed a tangent to the base circle, and were dead straight lines, except where they merged into a radius at the nose of the cam. To obtain reasonable efficiency, and avoid noise or waste of power, with such cams, the "followers" or tappets must have a rounded contour, and in practice they usually took the form of rollers pivoted on the ends of the rocker arms.

Equally good, or better, results can be obtained by reversing the order of things, that is, by using cams with rounded (convex) flanks, in conjunction with flat tappets or straight-faced rocker tips; such cams can be produced readily and accurately by quantity production methods, using copy-forming milling or grinding processes. In the present case, one cannot take advantage of these facilities, but when a lathe is the only tool available for machining, it is always just as easy to produce a circular arc as a straight surface, and generally very much easier. Moreover, eliminating the need for a roller on the end of the rocker arm is an obviously desirable feature.

The method of forming the cam contour adopted here entails the use of two simple fixtures in the lathe, namely, (1) a division plate for locating the angular position of the cam flanks, and (2) a throw jig in which the camshaft can be set to run eccentrically to enable the flank contour to be formed with an ordinary single-point turning tool. Accurately timed and formed cams for any single-cylinder four-stroke engine can be produced in this way, and multi-cylinder engine camshafts involve only multiplication of the indexing positions, as in the "Seal" and "Seagull" engines. Single cams, or pairs of cams, may be mounted on a mandrel and machined in the same fixture, but, as already explained, it is just as easy to machine all cams from the solid in their correct relative positions, and thus avoid the necessity of locating them afterwards.

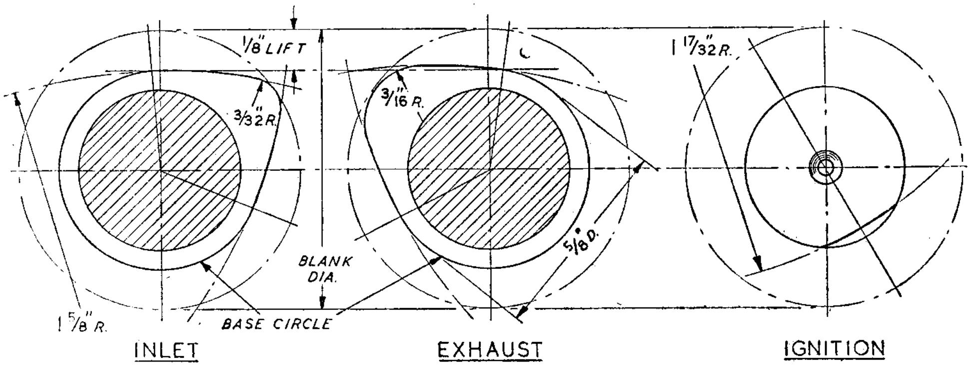
**Continued from page* 118, *"M.E.," January 24,* 1952.

The Division Plate

This may be made of steel plate or any other convenient material, attached to a central hub, bored $\frac{1}{2}$ in. diameter and equipped with a set-screw to enable it to be temporarily fixed to the camshaft. This screw should be of brass to avoid risk of bruising the finished surface of the shaft journal. The angular markings may be taken from the camshaft timing diagram shown here, using any convenient means of angular measurement, such as an indexing device in the lathe, or a toolmaker's protractor. In the absence of either, I have often set out the angles on paper, to a fairly large scale, say, 9 in. diameter, using a draughtsman's protractor, then mounted this on the lathe faceplate, and fixed the metal plate concentrically in the centre. The angles can then be transferred accurately to the plate with a scribing block, or better still, a point tool held on its side on the toolpost. At one time it used to be possible to obtain 360 deg. cardboard protractors for timing motor-cycle engines, but I doubt whether present-day motor cyclists or garage mechanics have ever heard of them!

I remember some time ago, when a youth applied for a skilled job in the motor industry, he volunteered the information that he had been employed in a country garage repairing tractors. "In that case," said the boss, "you should know something about engineering. I'll just ask you one simple question—how many degrees are there in a circle?" After scratching his head for a minute or two the applicant replied "I don't rightly know, sir—you see, we never used any of them there things on Fordsons!"

In case any readers may have any difficulty in understanding this timing diagram, which is set out in different terms to the usual timing diagram (the latter being based on crankshaft angles) it should be pointed out that it represents the angles on the half-time shaft, 360 degrees of which are obviously equal to 720 degrees on the crankshaft (two complete turns) and thus two "t.d.c." and two "b.d.c." positions are indicated. The positions of the cam followers, relative to the cams, must obviously influence the timing, and as the followers in this case are underneath the cams, the starting point (at the top of the firing stroke), is at the lowest point on the circle. Moving the camshaft in the direction of the arrow, the exhaust begins to open at $62\frac{1}{2}$ degrees from this point, which in terms of crankshaft angles, is equivalent to 125 degrees or "55 before t.d.c." The valve remains open until the entire return stroke is completed, closing $7\frac{1}{2}$ degrees past the vertical line, or "15 after t.d.c." Before this, however, the inlet valve has started to open, at "10 before t.d.c.", remaining open until "45 after b.d.c." on the compression stroke. It is only necessary to remember that the usual terms employed in valve timing are those of crankshaft angles, which are double those shown here, but for producing the camshaft the crankshaft angle must be divided by two in all cases. I may add that while this diagram represents a common and fairly efficient valve timing for a wide variety of engines, it could be modified a good deal without affecting efficiency very much in a low-speed engine. Some engines of this type have later exhaust opening and earlier inlet closing, with little or no "overlap" in the valve openings. In giving this diagram, therefore, I am simply recommending it as a practical one, which I know to be capable of producing reasonably good results, but I do not say it could not be improved upon.



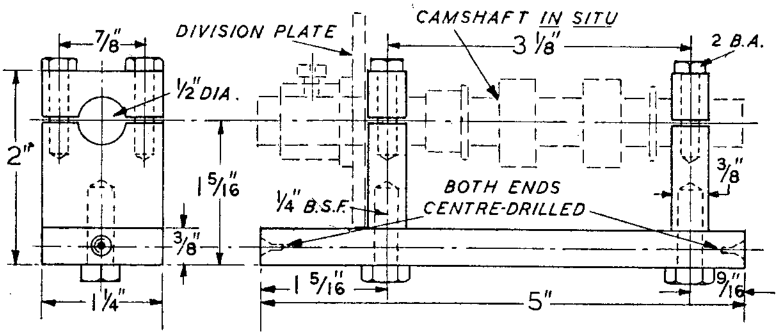
Cam contours and relative positions, viewed from contact-breaker end

The portion of the diagram marked "Ignition" may be ignored for the present, for the following reasons: first, because the position of the "follower," or in other words, the rocker arm of the contact-breaker may be indeterminate, and secondly, because a certain range of angular movement is normally allowed on the contact-breaker for "advance and retard" adjustment. This can usually be made sufficiently wide to cover any small discrepancy in the setting out of the ignition timing, and in many cases there is no definite limit to the range of adjustment allowable, up to a full 360 degrees, or "all round the clock." At the worst, therefore, the cam timing is not critical; the object of indicating the ignition timing is merely to give a guide as to the period during which the contacts are allowed to remain closed. Even this does not apply if a trembler coil is used, as in this case the spark takes place on the

" make," instead of the " break " and the timing of the cam, or the position of the breaker, must be altered accordingly.

The Turning Jig

This could be made of any convenient material, preferably steel, though in the example shown the only flat bar available in a suitable shape and size was of aluminium alloy, which was quite satisfactory. The base and uprights were cut from the same piece of bar, the latter being held in the four-jaw chuck for boring, and before



Cam turning jig, with camshaft and division plate indicated in dotted lines

splitting the eyes, the holes for the clamping screws were drilled and tapped in the ends. After splitting, the pieces were clamped on a short piece of $\frac{1}{2}$-in. round bar, both together, and held in the four-jaw chuck for facing the lower end, so as to ensure that they were exactly equal in length, from the centre of the eye to the base, so as to ensure that the shaft will be held parallel to the lathe axis. The base piece was carefully set up for facing and centre-drilling at the two ends, and the uprights mounted on it at suitable positions to take the camshaft journals, one set-screw in each being sufficient to hold them in place, as they cannot turn, when once the shaft is clamped in position. It will be seen that at the inner end, the shaft extends beyond the clamp sufficient to allow the division plate to be mounted on it. The dimension from the centre of the base bar to that of the shaft is arranged so that the required radius of the flank curve is obtained at a tangent to the base circle, that is ($1\frac{5}{8}$ in. — $\frac{5}{16}$ in.) = $1\frac{5}{16}$ in., when the jig is mounted between centres.

One point on which some confusion has arisen in the past is the arrangement for obtaining correct rotation, or sequence of cam operations. In this engine, the camshaft rotates in the same direction as the crankshaft, owing to the interposition of an idler gear ; in other words, clockwise at the *crankpin* end. As the division plate is attached to the other end of the camshaft, however, it might be thought that it is necessary to reverse the angles shown on the diagram, in order to obtain counter-clockwise rotation at that end. A little consideration will show, however, that by mounting the diagram on the shaft, and rotating it against a fixed index mark on the jig, the sequence of operations is, in fact, reversed, as compared to using a fixed diagram and a rotating index pointer. I mention this because several constructors have made fatal mistakes over this, and there has been weeping and gnashing of teeth as a result. Always remember that the diagram can be used either on the fixed or moving part, or facing either way on the shaft ; in each case, relative motion, or sequence of events, is reversed.

Machining the Cams

Having completed these preliminaries—which are less complicated than they seem, and take little longer to carry out than to describe—the camshaft may be mounted in the jig, the clamp screws firmly tightened, and the base bar mounted between the lathe centres. It does not really matter which way round it is placed, but in most cases it will be found convenient to have the division plate at the head end. There is no actual machining to be done at the " zero point " (t.d.c. on firing stroke) but it is a good idea to make a witness mark on one or both of the collars of the shaft by running the lathe slowly and feeding the tool in until it just skims a visible patch on the collar, which can then be centre-punched lightly. The division plate is then fixed firmly by its set-screw to the shaft, with the zero point against the index point or mark on the jig. The plate must not thereafter be moved on the shaft until the forming of the cam flanks is completed.

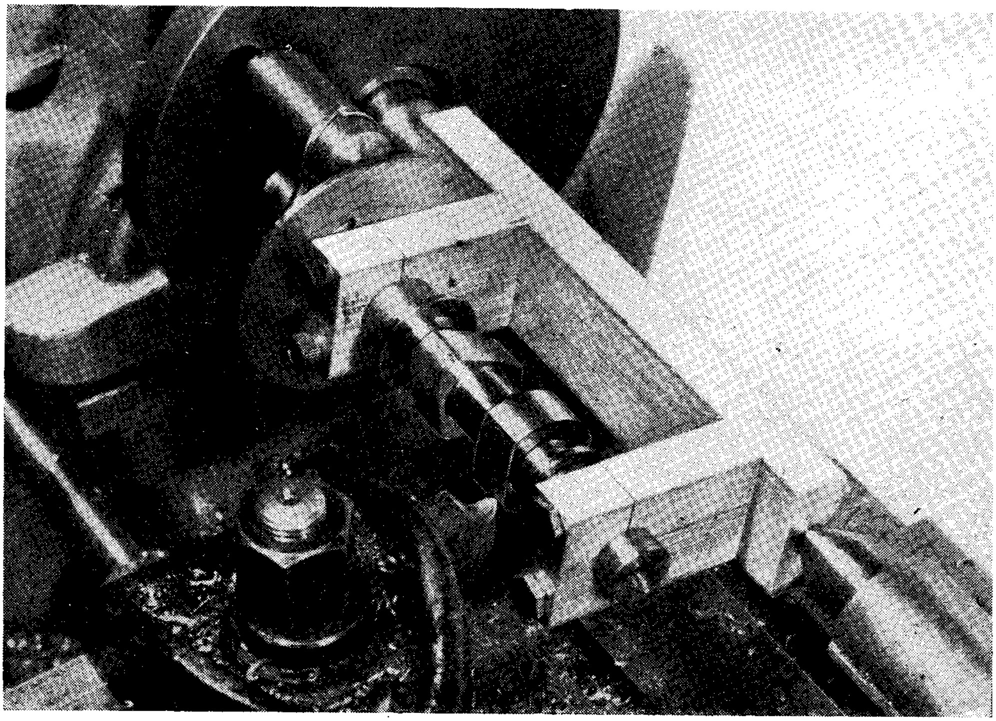
The clamp screws of the jig are then loosened, and the shaft then turned to bring one of the valve opening or closing marks against the index. It does not matter which flank of which cam is done first, as long as one works on the appropriate blank ; and even an error in this respect might be tolerated, as it does not matter really which is the inlet and which is the exhaust valve. In the present case, the exhaust valve is on the left, looking at the head end of the engine, therefore the exhaust cam is the one nearest the spur gear.

It is necessary to have some means of gauging the depth of cut when forming the flanks ; if the cross-slide of the lathe is equipped with an index, this will serve the required purpose, as precision in actual measurement is not so essential as uniformity. Failing a graduated index, it may be possible to fit a stop of some kind to the slide, to provide a definite limit to its travel. As the blank

diameter is $\frac{7}{8}$ in., and the base circle is $\frac{5}{8}$ in., it follows that the lift is the difference between the radii of these two circles, namely $\frac{1}{8}$ in., and this is the amount of cut which must be taken, after the tool point just touches the surface of the cam blank. It would be extremely difficult to get an exact measure of the radius from the lathe axis to the cam flank, so no attempt is made to do this.

The lathe should be run slowly—say, middle back gear speed—as the cut it intermittent and the surface speed equivalent to turning a $3\frac{1}{4}$-in. disc. at intervals of not more than five degrees, the surface will be to all intents and purposes truly circular. Before doing this, however, the nose of each cam should be marked with a dab of marking dye, just as an insurance against mistakes, which might possibly result in scrapping the job.

Alternative methods of machining the base circle are by " planing " the metal away with a tool held on its side, by circular milling, or the use of a filing rest, such as that described in the " M.E." handbook, *Lathe Accessories.* Strictly speaking, the base circle should be undercut to



Camshaft set up in jig between lathe centres, showing flank turning operation in progress

It will be found desirable to wire the jig to the driving pin to prevent it clattering. Take light cuts with a keen, well raked tool, not too wide on the point, and lubricate the work freely. Make quite certain that each cut finishes exactly on the chosen index mark—if one should go deeper accidentally, it would be better to machine all the other flanks to the same depth than to have one of them out of step.

Machining Surplus Material

When the two flanks of each cam have been completed, the surplus material on the opposite side to the lift must be machined away, down to the radius of the base circle. The simplest way to do this is to rotate the shaft into a number of different positions, and take a cut down to the same depth as the cam flanks, at each position. If a sufficient number of such cuts are taken, the extent of a few thousandths of an inch, to allow for tappet clearance, but this is not of great importance in an engine of this type, where clearance can be kept very small, and the only effect of variable clearance would be to reduce the lift, and the angular period, very slightly.

The nose radius of the cams can be filed by hand, as its shape is not critical, and it is only necessary to blend the flank contour into the tip radius as smoothly as possible. The entire surface of the cams should be finished to a high polish with fine emery-cloth, so that they work with the minimum friction in contact with the followers. It remains now to machine the end of the shaft to form the contact-breaker cam, which can be done by the same methods, and in the same jig, but in view of the remarks on ignition timing above, it should be left for the time being.

(To be continued)

"JULIET" WITH OUTSIDE VALVE GEAR

by "L.B S.C."

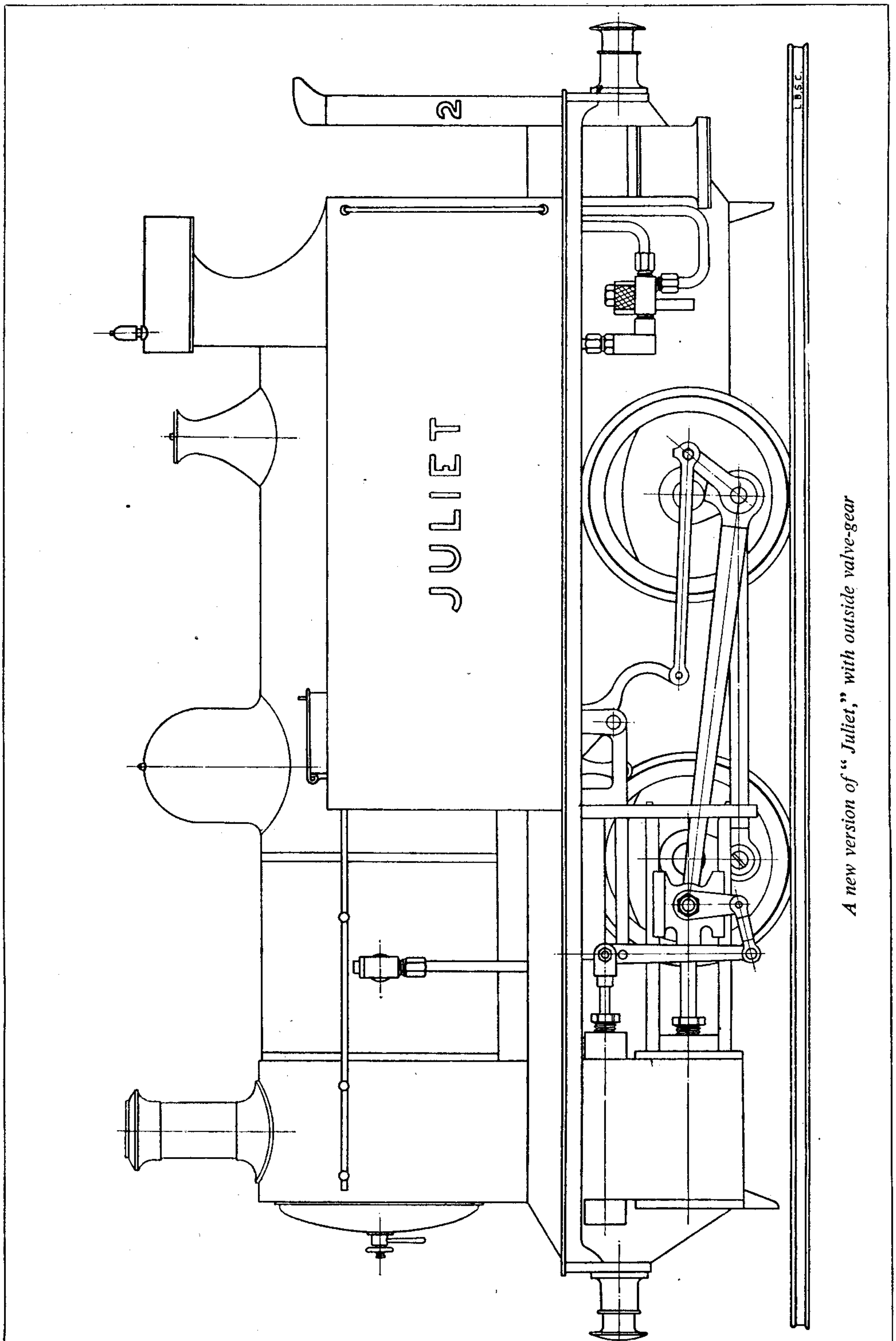
SOME new readers of this journal, wishing to build a simple, cheap, yet powerful little locomotive with the "L.B.S.C." guarantee behind it, and somewhat bigger than *Tich*, have discovered *Juliet*, taken a fancy to that energetic little lady, and decided to build one of that type. However, they don't care about fitting a valve gear between the frames; so are asking, first, can an outside valve gear be used, and secondly, if so, will it be much of a ticklish job to connect it up to the inside valve spindles. I can soon put their minds easy! Outside valve gear can certainly be used; and whilst it could be connected up to inside valve spindles by means of pendulum levers, as on the 4-6-4 tank engines of the old L.B. & S.C. Ry.—incidentally a rather unusual arrangement in full-size practice—there is no need for this. As they are starting from scratch, the easiest way would be, to fit cylinders with valves on top; and the connections can then be made direct.

In order to make things as clear as possible, I am offering a fresh drawing of the complete locomotive, with the arrangement of cylinders and valve gear mentioned above. The cylinders are the same size, viz.: 1 in. bore and $1\frac{1}{2}$ in. stroke, but are arranged horizontally, instead of being inclined, in order to get the overhead steam-chests below the running-boards, and keep the job nice and neat. The valve gear is Baker. Now certain persons have said unkind things about Baker valve gear, and the assertion is frequently made, that it won't notch up. Well, don't you believe it! American locomotive engineers have their noddles screwed on the right way; and before the Diesel craze bit the American railroads, there were upwards of 24,000 locomotives fitted with Baker gear. Can you imagine that happening, if the gear wouldn't notch up, or "hook up" as the transatlantic enginemen say? "Facts are chiels that winna ding, an' dauna be disputed," says Bobbie Burrrrrns. The reason that no British full-size locomotives have Baker gear, is twofold; one, the well-known British "conservatism," and two, the patent rights are owned by an American company, and users would either have to purchase the gear sets from the company who makes them, or pay a royalty. As American locomotive builders prefer to buy their components from specialists, this is no deterrent in U.S.A., but Britons being what they are—nuff sed! It was your humble servant who introduced the Baker valve gear to the small locomotive fraternity in this country; my engine *Fayette* was the first to be so fitted. There was no royalty to pay on weeny home-made gears; in fact, the company welcomed the advertisement. The gear being easy and simple to make, no slotted links, no die-blocks, no lost motion, it "caught on" and became popular; and deprecatory remarks about it can be put down to a mixture of ignorance and prejudice. Some folk would find fault with an angel! I was extremely interested to note that the $7\frac{1}{4}$-in. gauge 0-4-0, illustrated on page 826 of the issue of December 20th last, was fitted with Baker valve gear, probably enlarged up from one of my drawings, though Messrs. Mallaby didn't say so. Well, let's get on with the job; and may I remind all interested folk, that full-size blueprints of the revised *Juliet* will be available from our offices, and from approved advertisers who sell Percival Marshall publications. I am only making fresh drawings for the revised parts; all the rest of the components shown on the original drawings are still incorporated in the "new look *Juliet*," as they are tried, tested, and not found wanting.

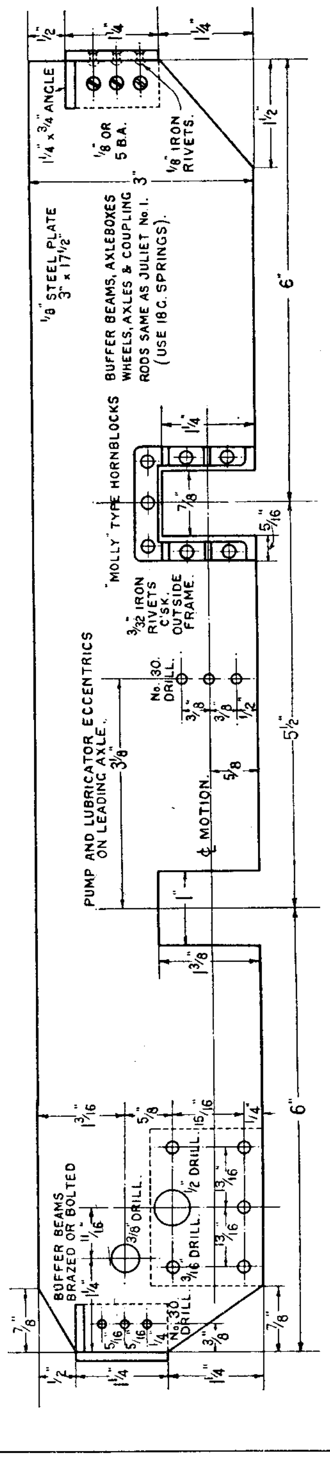
Frame Alterations

As on the original version, the frames are "all straight lines," and can be cut out in a matter of minutes, same as those for *Tich*, by anybody who possesses, or has the use of a bench shearing machine, or a guillotine cutter. My Diacro shear would make short work of them, if operated with an extension lever. The hornblock openings are the same as on *Juliet No.* 1, and are cut to suit the cast hornblocks I specified for *Molly*, *Iris* and other $3\frac{1}{2}$-in. gauge engines. This time, however, there is no opening to cut for accommodating inside steam chests; only holes to drill for the steam and exhaust pipes, and the studs or screws used for attaching the cylinders to the frames. The location of the bolting face of the cylinders, is shown by a dotted rectangle measuring $2\frac{1}{8}$ in. $\times$ $1\frac{1}{2}$ in.; and as the bottom of it is level with the bottom edge of the frame, and just touches the angle where the frame slopes upward to the buffer beam, there isn't much likelihood of any builder putting it in the wrong place! The centre-line of motion is horizontal, and $\frac{5}{8}$ in. from the bottom of the frame. Whilst you have the frames riveted together, for cutting the hornblock openings and drilling the holes, mark the centre-line of motion, and position of the cylinders, on the outside of both plates. It saves a lot of fiddling about afterwards.

The holes are easily located, if a vertical line is scribed at the front end, $1\frac{15}{16}$ in. from the edge to which the buffer-beam will be attached. On this line, at $\frac{1}{4}$ in. from the bottom edge, drill a $\frac{3}{16}$-in. hole, and another at $\frac{13}{16}$ in. either side of it. Drill three more, $\frac{15}{16}$ in. above the first three, and exactly over them; enlarge the middle one to $\frac{1}{2}$ in. At $\frac{5}{8}$ in. above this, and $\frac{11}{16}$ in. ahead of it, drill a $\frac{3}{8}$-in. hole for the cross steam pipe. The latter, on this version, goes straight into the side of the steam chests, which will be similar to those specified for *Tich*, only a size bigger. If you are intending to attach the buffer-beams by pieces of angle, drill three screwholes at each end, as



A new version of " Juliet," with outside valve-gear



Details of the frame plates

shown, but the easier way is to braze the beams to the frames, as when once erected, they never need taking apart any more, and there is no fear of a brazed-up assembly going out of truth, or anything coming loose.

As the valve-gear eccentrics have been eliminated from underneath the ashpan, we might as well finish the job and eliminate the pump eccentric as well, by turning the pump the other way around, so that the gland points forward, and driving it from the front axle. Some folk reckon that all the driving strain should be taken from the driving axle, but this is not essential, which should be obvious when it is considered that the tractive effort of the engine is divided among the coupled axles. The extra strain of driving the feed-pump from one of the coupled axles, adds such a small amount of stress to that axle, that it is practically negligible. Old *Ayesha's* pump has been operated from the leading coupled axle for over thirty years, and there hasn't been the slightest ill-effect. About two years ago, I altered the drive of the mechanical lubricator; originally it was connected to one of the valve spindles. I fitted a fresh ratchet wheel, which required more movement of the ratchet lever; so I made a new eccentric, wide enough to take two straps side-by side, and fitted it on the leading coupled axle, in place of the original pump eccentric. One of the new straps operated the feed pump; and the other, the mechanical lubricator. Incidentally, I might just as well have saved time, and scrapped the pump altogether, as I nearly always use the injector. It makes the job of driving her, a little more interesting. In the ordinary course of events, with the pump bypass set, she monotonously reels off lap after lap, with hardly any effort, the only attention needed being two or three shovelfulls of coal every now and then. About the only thing that prevents me from going to sleep, is an occasional spark down my neck, when the coal is a bit dusty! I believe the old cat does it on purpose.

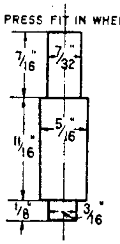
However, reverting to the job in hand, if you take a look at the frame drawing, you'll see that the holes for the screws, holding the pump stay, have been shifted to a position $3\frac{1}{8}$ in. from the centre of the leading axle. This allows the pump to be erected, barrel pointing forward, with the valve-box a full $\frac{1}{8}$ in. ahead of the boiler throat-plate; this leaves the space below the firebox, quite clear except for the driving axle, and a deeper ashpan can be fitted. The firebox can also be made deeper, by anybody who prefers deep fireboxes. The pump eccentric-rod will, of course, be shorter, but this isn't any detriment, as the pump ram is amply supported, and can resist the angular thrust.

Details Same as No. 1

After parting the completed frames, fit them up exactly the same as described for the original *Juliet*. First item will be hornblocks, one of my standard patterns as mentioned above; then the buffer beams, which are $6\frac{1}{2}$ in. lengths of $1\frac{1}{4}$ in. $\times$ $\frac{3}{4}$ in. $\times$ $\frac{1}{8}$ in. brass or steel angle. They could also be iron castings, though in the event of a collision, they might get broken. Steel beams can be attached to the frames by

brazing, or by angles, as shown on the original drawings ; brass beams should be fixed by angles, as they won't stand brazing heat. Take care to have the frames erected all square and level, as fully described for *Tich*. Details of buffer beams, hornblocks, axleboxes, hornstays, springs, wheels, axles, and coupling-rods are given on the blueprints of the first *Juliet*, and it will save time and space if builders of the " revised edition " will refer to them. The sequence of operations is the same as described in full for the original engine, and also for *Tich*, so there is no need for repetition.

Note the following points. Instead of the crankpin in the driving wheel having a screwed end, it has a plain spigot, $\frac{3}{16}$ in. diameter, and a full $\frac{1}{8}$ in. long, to carry a return crank, which will be illustrated and described with the valve gear. Both eccentrics are mounted on the leading axle. They are both made as shown in the illustrations of the original engine, and on the blueprints, for driving the feed pump ; but the throw of the lubricator eccentric should be $\frac{3}{16}$ in. (for $\frac{3}{8}$ in. stroke) that for the pump remaining at $\frac{1}{4}$ in. (for $\frac{1}{2}$ in. stroke). Don't forget to put them on before pressing on the wheels ; the pump eccentric goes in the middle of the axle, and the lubricator eccentric between it and the right-hand leading axlebox. All the springs should be wound up from 18-gauge tinned steel wire.



Driving crankpin

The feed pump is made as previously described and illustrated for the original *Juliet*, no alteration being necessary for its reversed position. The only difference is in the length of the eccentric-rod ; and the exact length can be obtained from the actual job. Cut the rod, after attaching it to the lug on the strap, so that when the ram is pushed right home in the barrel, and the eccentric is on back dead centre—that is, nearest to the pump—the rod just fits into the groove in the ram. With a bent scriber, make a mark at the end of the rod, through the cross-hole in the ram, in the form of a little circle. Remove rod and strap, and make a centre-pop on the rod, 1/32 in. nearer the strap, than the centre of the little circle. Drill the marked place with No. 34 drill, ream $\frac{1}{8}$ in., and case-harden the eye after filing it to the shape shown on the blueprint. Alternatively, the rod can be drilled $\frac{3}{16}$ in., and a bronze bush squeezed in, the bush being reamed $\frac{1}{8}$ in. The pin should be $\frac{1}{8}$ in. silver-steel, reduced at each end and screwed 3/32 in. or 7 B.A., and furnished with nuts. When the nuts are hard up against the shoulders, the pin should still be free to turn by finger pressure, ensuring that the slotted end of the ram isn't squeezed in enough to grip the eccentric rod and cause undue friction.

I nearly forgot to mention that the screwholes for the pump stay need not be countersunk, as they are well clear of the wheels ; and screws having hexagon, round, or cheeseheads can be used for attaching the pump stay to the frames. The above little dissertation should enable builders of *Juliet No.* 2, to go right ahead and get frames, wheels, and other etceteras all erected, ready for the new type cylinders ; and all being well, I will describe and illustrate these in about the third issue from now. Referring to the reproduced general arrangement drawing, I have shown the revised *Juliet* with boiler mountings, cab, and bunker which are reminiscent of the old Great Western Railway in the days of William Dean, when slender copper-topped chimneys and huge polished brass domes were the order of the day. Do you know, or can you guess, why I did it ? No ? Well, I'll tell you. The room where I do all my writing, drawing, and correspondence is our first-floor-back, and the window overlooking the railway is a fairly large three-pane affair of the casement type ; my drawing-board is in front of it. Just as I was about to put the boiler mountings and cab on the drawing, one of the ugliest type of locomotive ever conceived, a Bulleid Q1, went by with ten empty ballast wagons and a brake. I mentally compared the horrible nightmare with the pretty little tank engines that ran on the G.W.R. in my young days ; and the vision of the latter, as I knew them, was so vivid that I put their appurtenances on my drawing. I hope you like them. Incidentally in the big raid on Canterbury during the war, one of the nightmares was blown up near the station ; and several Southern enginemen of my acquaintance said that if they knew the Jerry who did it, they would not only have let him go, but presented him with a medal !

Cross Oil-Grooving a Bush

(*Continued from page* 169)

Accordingly, the angle-iron was drilled for a $\frac{1}{4}$-in. bolt to secure the skate roller and the other face was drilled the same size at two points to take bolts in the saddle tee-slots.

Now, this didn't allow the saddle cross movement to be varied, so the toolpost slide was turned round to work from the rear and its movement used to apply the feed to the tool. Round it may be seen a rope. That carried a heavy weight dangling over the lathe stand end. It kept the carriage against the wabble plate, assisted by a precautionary push as well when operating. A return roller is seen as well ; it was not used because of the backlash it required.

The bush to be cut was in bronze and of $\frac{3}{4}$ in. bore. Each turn of the mandrel took the carriage there and back, cutting an oblique loop in the bore. Turning was by hand, for the use of power would set up a shocking dance that would have wrecked operations. Having cut one loop, the bush was rotated 180 deg. in the chuck and the second loop cut similarly, and, of course, cutting across the other centrally in the width. Finally, the annular end grooves were cut normally.

*CAMERA DESIGN

An article of great importance to every reader whose interest centres on the field of photography

by Raymond F. Stock

IT will be seen from the drawing (Fig. 21) that each leaf is shaped on one side to clear the pivot of the adjacent leaf, and on the other side to present a circular aperture when fully open. Projecting from one side of the operating ring is a fork engaged with the shutter lever **S** ; movement of the latter (against its spring **B**) will open the shutter—releasing it will allow the shutter to close ; and this function is carried out by the intermediate lever **L.** **L** is tripped by the trigger ; initial movement " picks up " **L** and compresses spring **A** and further movement of **L** carries it over and past the shutter lever.

At a certain point the trigger " loses " **L** which flies back, picking up the shutter lever as it goes. The latter is forced by the proportions of the levers to follow the movement of **L** until it also is finally " lost " by **L.** In the process the shutter is opened and closed. It will be realised that the speed of opening of the shutter is determined by the velocity of **L** as it flies back : the speed of closing is determined by the velocity of the shutter lever. Both velocities depend on the tension on springs **A** and **B**, and both are independent of trigger speed.

As described, the shutter would commence to close almost immediately after opening, and this is in fact what occurs when the fastest speeds are selected. For slower speeds a delay device is used. Fig. 22 shows the layout.

Lever **Q** has a toothed quadrant and drives a pinion and wheel ; the latter is restrained by having to oscillate the weighted lever **T.**

Lever **Q** is picked up by another projection on **L,** just after the shutter has been fully opened. The subsequent movement of **L** before releasing the shutter, is thus restrained by **Q** and a time-lag between opening and closing is obtained.

Variation in speeds is made by a cam which moves **Q** more or less through its travel before the shutter is tripped, so that the length of travel, and therefore time, for which **L** is restrained by **Q** is varied.

The cam is of course operated by an external knob or pointer.

Provision of " Time " or " Bulb " (short time) is effected in fairly obvious ways by the provision of other levers (brought into action by the variable speed cam or by a separate control) which arrest **L** in its travel after it has opened the shutter. For " bulb," releasing the trigger must release **L,** while for " time " **L** must be locked until the trigger is again depressed. In some cheaper cameras a catch is arranged, often externally, to retain the trigger open in the " bulb " position thus dispensing with any separate device for " time."

It will be realised that the above description is general and many variations are possible. The drawings show the levers arranged for clarity, though in practice they are usually curved and overlapping in order to be accommodated within the annular space of the shutter body.

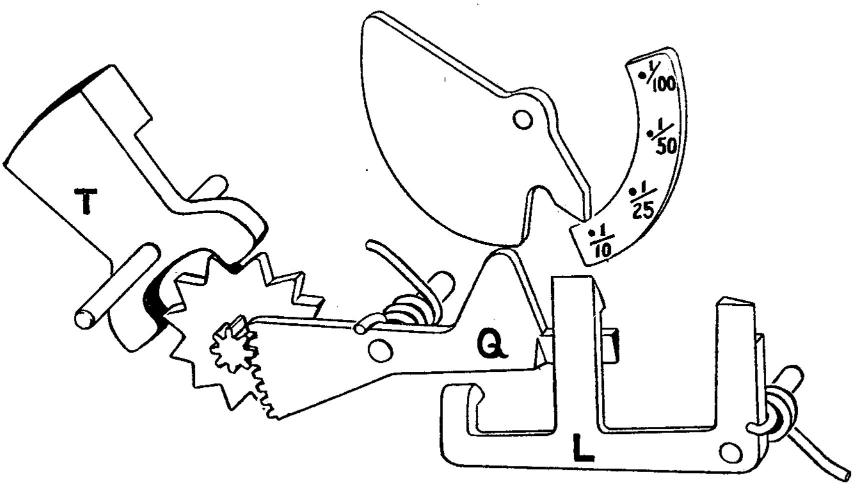


Fig. 22. Shutter delay mechanism

*Continued from page 146, " M.E.," January 31, 1952.

Construction is similar to watch practice, the mechanism being pivoted between motion plates. All pins are generally hardened and the levers must resist wear on their tips, though non-ferrous materials are commonly employed. The rear motion plate carries the pivots for the shutter leaves, and the latter, a distance ring, the iris diaphragm and the backplate of the shutter case form a thin sandwich. The rear lens element(s) screws into the backplate, and the front lenses into the front motion plate.

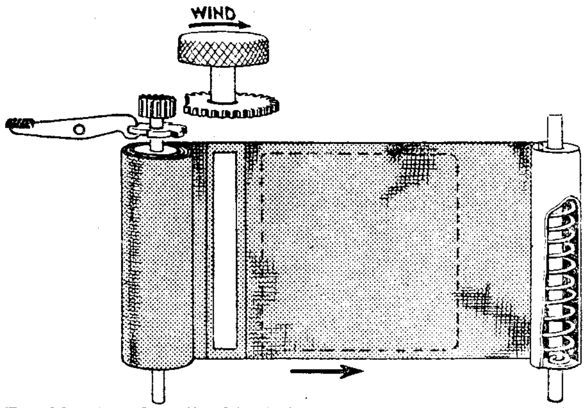


Fig. 23. Simple roller-blind shutter. Position of plate dotted

To reduce trigger pressure a separate knob is sometimes fitted which carries out the initial movement of **L**, release only being effected by the trigger.

A good between-lens shutter of this type can work at 1/500 sec. though 1/250 is more usual. The marked speeds are arranged to have, approximately, a $\times$ 2 increase at each step, a common series being : 1/500, 1/250, 1/125, 1/50, 1/25, 1/10 and 1/5.

Sometimes the slow speeds of 1 sec. and $\frac{1}{2}$ sec. are provided and this naturally calls for rather careful design of the delay mechanism, though the same basic idea is used.

Amateur constructors will find some method of speed testing essential. Probably many readers have seen the electronic testing gear in action at the South Bank exhibition and if so will recognise the graph in Fig. 20 as similar to the cathode-ray trace shown. Quite good results may be obtained without elaborate apparatus, however, by photographing through the shutter any moving object whose velocity is known. The most convenient object is a wheel having a known r.p.m. : e.g., a gramophone turntable for slow speeds, or a lathe faceplate. A bright object such as a ball (bearing) or small torch is secured to the wheel, and on the developed negative one should be able to measure the angle subtended by the image, and thus calculate the shutter-speed.

Focal plane shutters mean by definition any shutters used immediately in front of the focal plane (plate), but roller blind shutters are so convenient in this position that the names have become synonymous.

A shutter of this class has a flexible opaque blind (generally of material, but occasionally articulated metal) which is drawn rapidly across the plate by spring tension as shown in Fig. 23. In the blind is a slit which makes the exposure as it travels across the plate. Obviously the exposure given to any point on the plate depends on the spring tension (speed of blind) and slot width, and either or both of these factors may be varied to control the speed.

The upper limit of slit width is limited by the bulkiness of a very long blind though for time exposures a " slit " equal to the width of the plate must obviously be provided. The lower limit for the slit is dictated by mechanical considerations for, in order to obtain an absolutely even exposure of all parts of the plate, the width of the slit must be absolutely constant. Accuracy to, for instance, 1/100 in. is adequate when the width is 1 in., but inadequate when the slit is reduced to 1/32. In the last analysis the minimum width would be limited by *diffraction** effects.

It might be thought simple to produce an accurately parallel invariable slit by using a metal frame at that point, and in fact this is done in the rather long type of blind which has multiple slits. Any particular slit, corresponding to a particular " speed " is selected by the amount of blind wound on to the release roller before exposure, the winding knob being turned an appropriate amount as indicated by a pointer on a scale.

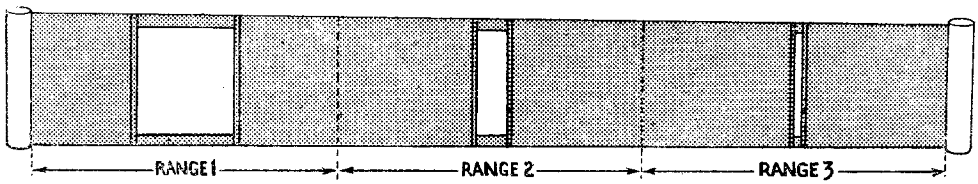


Fig. 24. Three-slit blind

The release device permits the roller to turn only sufficient for one slit to pass across the film (see Fig. 24).

In a second type of shutter the blind is actually in two parts, their adjacent ends (suitably stiffened by metal) forming the slit.

* Rays of light may be bent when passing through a narrow slit or small hole, with consequent deterioration of the image.

The separation of the ends is variable (and therefore the slit width controlled) by winding the leading blind more than the trailing blind, and by a predetermined amount ; this is achieved by continuing each blind by a pair of tapes wound on to what are virtually separate rollers. A slit of this type, covering a 3¼-in. × 2¼-in. plate, might have a range of adjustment of from about

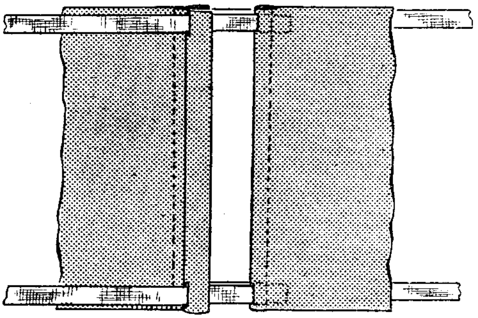


Fig. 25

⅛ in. to full plate width, a stop mechanism being employed to hold the wide slot over the plate in time exposures.

It will be seen that in either type of shutter it is necessary to prevent light reaching a film whilst rewinding, though if plates are used the question does not arise since the blind may be wound before the plate is inserted.

To achieve this two methods are available. With slots of fixed width it is necessary to employ a second separate blind immediately in front of the exposure blind. It is known as a *capping* blind and is driven by a gear train from the winding knob, so that it is drawn across the focal plane before the exposure slit begins to move during rewind. After the exposing blind is set the capping blind is released and its slit, the full size of the plate, occupies a central position. Capping blinds are made in the same way as exposing blinds and are wound on to similar rollers, one being spring loaded. Naturally their use causes a considerable complication in design and construction.

Blinds having variable slit widths do not generally use a capping blind. The slit is entirely closed during rewinding and this is achieved by stopping the leading blind at the end of the exposure before the trailing blind, so that the latter continues on and either overlaps the other blind or fits into a socket forming the other slit edge. Fig 25 shows the idea.

To accommodate a wide range of speeds—say from 1/10 to 1/1000 sec. it will generally be found necessary to vary the speed of the blind (i.e. the spring tension) as well as slit width, and this is done by extending the shaft acting as a spring anchor outside the camera, and fitting a tension knob and scale, as in Fig. 26.

In this connection it should be remembered that there is a considerable difference between the *effective exposure* of any one point on the plate and the *total time taken to complete the exposure*, and that this discrepancy is increased with narrow slits. The practical result of this is that any one part of the plate is exposed for, say, 1/1000 of a second, but perhaps 1/100 of a second after another part of the plate. While the effective exposure may be short enough to give a clear picture of a hydroplane at speed, the image of the model will have moved an appreciable distance between beginning and end of the exposure : thus one part of the model will be photographed before another, resulting in distortion.

If the blind moves transversely the model may be either elongated or shortened according to whether the slit moves in the same direction as the image of the hydroplane, or in the opposite direction. If the slit moves vertically the model will appear leaning either backwards or forwards.

This point should be considered when designing the direction of a blind, always remembering that the image moves in the opposite direction to the object.

Other considerations may influence the direction of slit travel, however, such as the need for reducing the length of the slit or on the other hand reducing the length of the blind, these factors being influenced by the proportions of the picture to be obtained.

If high shutter speeds are required a focal plane shutter is indispensable and is much easier to make than an iris shutter.

Precision work is not necessary, and materials are not difficult to obtain. Cloth for blinds may be cannibalised from surplus R.A.F. cameras and at least one advertiser is offering blinds alone. As a starting point for the design it is best to fix a certain maximum time for the fastest

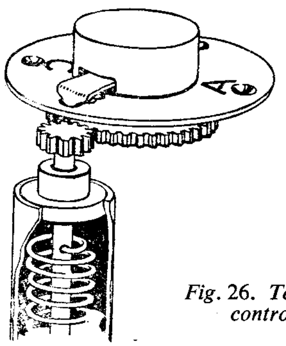


Fig. 26. *Tension control*

exposure to occupy (say 1/100 sec.) and then to calculate the slit widths to give the required effective exposures. Spring tensions will, of course, be adjusted by experiment.

Expensive cameras have compensation introduced to prevent acceleration of the blind in its travel, and to some extent this is in any case provided by the natural reduction in torque of the spring, as it unwinds. It is wise to design a blind to have some movement before beginning exposure to minimise acceleration effects, which will show up as a change in density of the developed image across the plate in the direction of blind travel.

(To be continued)

*A STAND OF TILT-HAMMERS

by W. J. Hughes

(Photographs by the author)

FOR the model, the shape of the wheel was set out on card pinned to a drawing board. To this were cemented eight shaped segments to form the rim, and a circular piece for the boss. Small pieces of balsa sheet $\frac{1}{16}$ in. thick were cemented in the dovetailed gaps of the rim, to represent the wrought-iron slabs ; deal blocks were carefully fitted to represent the spoke-ends. The and spur wheel, and it will be noticed that the cams are not "fully-detailed." Instead of being fitted into sockets with wedges, they are simply short lengths of $\frac{1}{4}$-in. steel rod forced into 15/64-in. holes drilled in the beech rings. Incidentally, an error was made here, which was not realised until later, for the cams should be so placed that the nose-helve hammers are

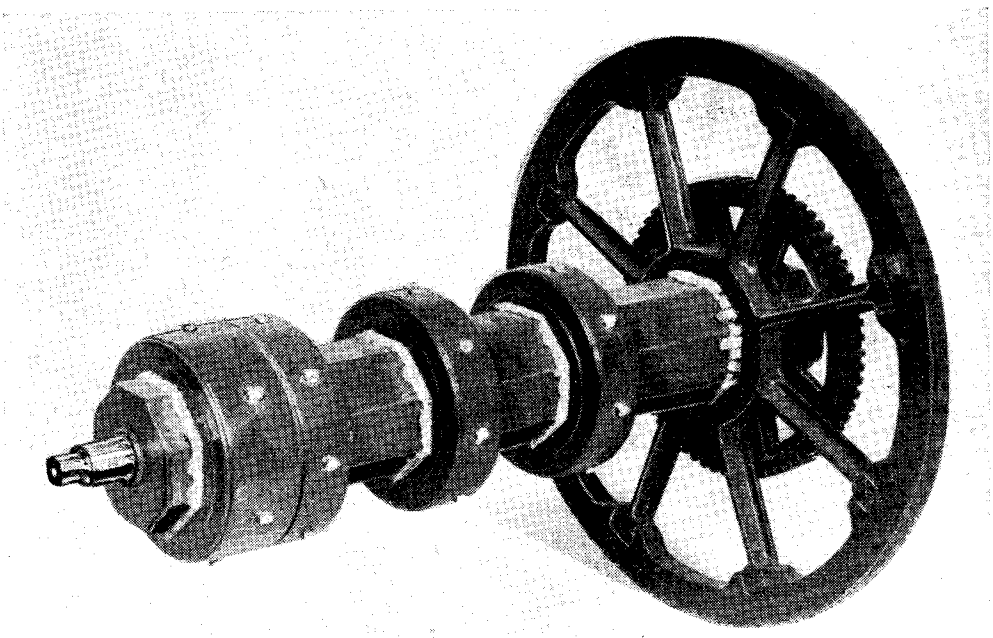


Fig. 11. *The model camshaft, complete with cam-rings, flywheel, and spur-wheel*

remaining parts of the spokes were built up in balsa, and the card between the spokes cut away with a sharp knife, leaving a strong and rigid wheel, which was eventually wedged to the shaft and trued up using the wedges in the orthodox manner, by slackening one and tightening another until the wheel ran true.

The spur-wheel was built up in a very similar manner to the flywheel, except that the spokes are cruciform in section and not tee-section. The "teeth" are simply short lengths of balsa of $\frac{1}{8}$ in. square section cemented in position on the rim.

Fig. 11 shows the complete camshaft, flywheel, out of step with each other in working, so as to distribute the load more evenly on the water-wheel, flywheel, and foundations, by giving twenty-four strokes per revolution. As it is on the model, these three hammers are lifted together, giving eight heavy beats per revolution. There are only seven cams for the nose-helve hammer, which does, therefore, throw this out of step with the others.

The Hammers

As seen in Fig. 12, the helves of the tail-helve hammers consist of tree-trunks, bound with wrought-iron straps. The heads are forged to shape, with a socket underneath to take the separate die or "tup", which struck the actual blow. Perhaps differently shaped dies could be fitted

*Continued from page 137, " M.E.," January 31, 1952.

Fig. 12. A standard and bearing for one of the tail-helves. The square holes in the cam-rings are to take the cams with their wedges, and the holes in the sides are to enable the wedges to be knocked out

for different work, or maybe the idea was just to allow for easy replacement.

In the model the helves are of deal, "reinforced" with bands cut from copper sheet. The heads were end-milled and filed to shape in my own home workshop, but the tups are integral with the rest of the head, instead of being separate. They are held in place with wedges hammered to shape from 16-g. brass, in place of the forged iron of the prototype.

The pivots were filed up from $\frac{5}{16}$-in. square brass rod, and these work in brass bearings—not a happy combination, but the model will do little actual work. Fig. 13 shows the full-sized pivot and bearings, together with the packing and wedges used to hold the latter in its standard, while Fig. 14 shows two of the model tail-helves and a pair of bearings. Notice in Fig. 6, by the way, that the central hammer has a longer helve than the other two, which is in accord with full-size practice.

Also seen in Fig. 14 is the model nose-helve, which is built up in wood. The tup, not seen in this photograph, was filed from a handy chunk of dural, and a separate iron shoe is fitted to the nose to take the wear. This is fixed with a

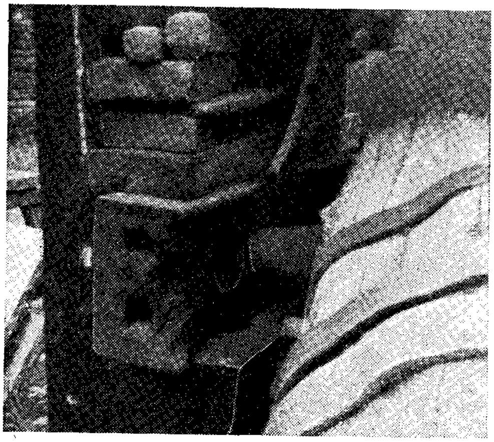


Fig. 13. Bearing and pivot of one of the tail-helves. Note the assorted packing to hold the bearing in place

cotter above the nose, as in the original. Fig. 15 shows the whole nose-helve assembly.

The full-sized anvils at the front (Fig. 16) are iron, fitting with wedges into stone blocks. In the model they are similarly made, but the stone is represented by wood.

The Water-wheel

At this stage it was thought that the model was

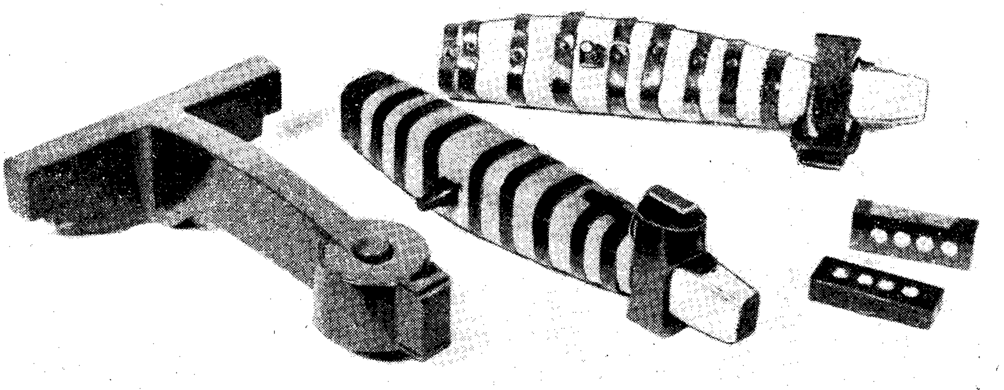


Fig. 14. The model nose-helves, two of the tail-helves, and two bearings

complete. The wooden parts were stained, and the parts made of metal were painted black. Those which were to simulate metal were "filled" with Alabastine to kill the grain of the wood, and well rubbed down, followed by two or three coats of enamel. The base was raised by adding 4 in. × $\frac{5}{8}$ in. strips of wood to the sides (to give clearance for the flywheel), and was then painted matt-grey. While the paint was tacky, silver sand was sprinkled all over it, and worked in with the brush to resemble concrete.

However, the model was definitely lacking in something; moreover, few of the children who saw it had ever seen a waterwheel, and it was, therefore, decided to add the latter. But, as already mentioned, authentic details of the prototype Jessop wheel were not available, so that which drove the tilts at the Abbeydale works was chosen. It was measured up, photographed, and drawn to scale, and work started with a will, for comparatively little time remained before the Festival of Education, in which the whole model was due to feature at a central exhibition.

The water-wheel is 18-ft. diameter with a face of 5 ft. 8 in. It carries 48 buckets, and is known as a "ten o'clock" wheel, for, viewed from the working end, that is the place where the water hits the buckets. The cast-iron rims are in eight segments, riveted together, with wooden spokes bolted and wedged into brackets cast on the sides of the segments.

Wooden planks form the buckets, being bolted to lugs cast on the inside faces of the rims. A complete circle of planks forms the inside of the wheel; then forty-eight narrow planks are set radially to form the "bottoms" of the buckets, and finally wider planks again are set at an angle to catch the water and to form the outsides of the buckets.

The hubs of the wheel consist of two iron castings at each side, with lugs cast on between which the spokes are wedged. Bolts pass through the castings and the spokes to make them more secure. The whole construction is shown fairly well in Fig. 17 and 17A.

Fig. 16. One of the anvils in its stone block, with the broken tail-helve behind it

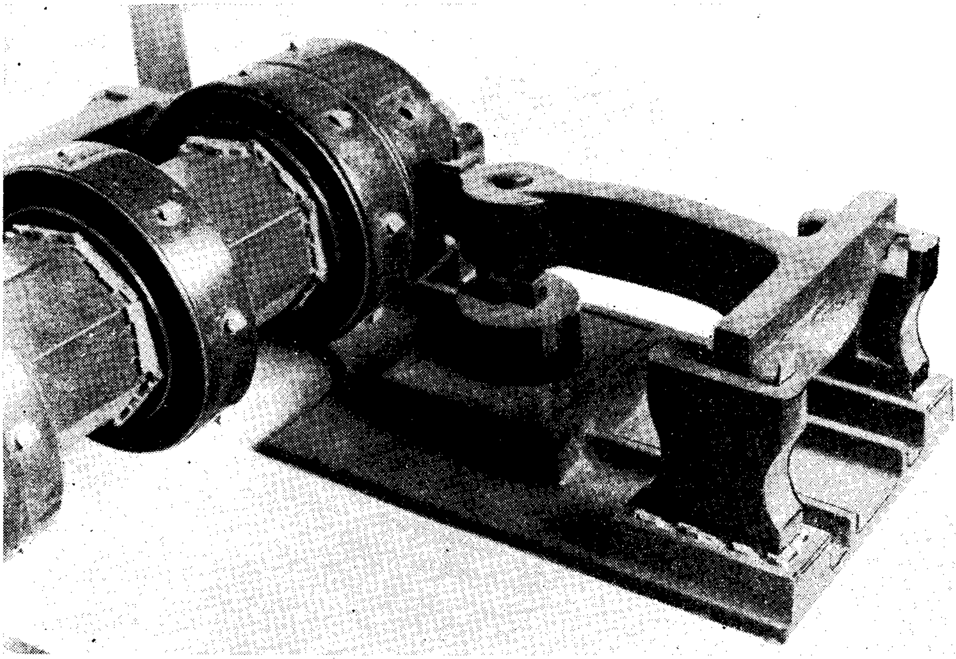


Fig. 15. Model nose-helve assembly complete. Note the extensive use of wedges to secure everything in position

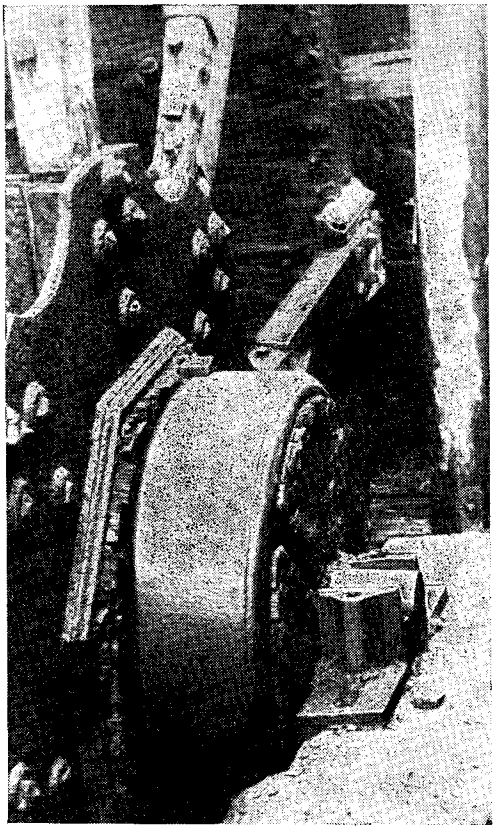


Fig. 17. *Centre of water-wheel and method of mounting wheel-shaft*

As before, the wheel is fixed and trued up with wedges on an octagonal shaft, but of wood this time. The method of fixing the journals to the shaft is interesting and ingenious (Fig. 17). Cast in one with each journal are four radial "spokes," with an external rim. The end of the shaft is slotted to take the spokes, and rounded to take the rim, the casting then being secured to the shaft by wedges. The journals run in half-bearings secured to baulks of wood which in turn are bolted to the masonry surrounds of the wheel-pit.

Water pours into the buckets through a sluice which works in a "tank" above the wheel. This tank has cast-iron sides, with timber ends and bottom bolted on, and is fed by a "goit" or conduit (which is similarly constructed) from the dam behind. A system of levers is fitted to enable the supply of water to the wheel—and so the rate of the hammers—to be regulated from the hammer-position itself.

In the model, all this was faithfully portrayed to scale, except that most of the metal parts were modelled in wood as before. One point of regret was that the bolts which hold together the various parts of the wheel, and those which hold the parts of the tank together, had to be omitted because of (*a*) lack of time and equipment to make them and (*b*) lack of money to buy them! Figs. 18 and 19 show the wheel and sluice mechanism.

The Cog-wheel

The large cog-wheel which is mounted on the water-wheel shaft has cast-iron rims which are held by timber spokes wedged and bolted to angle-sockets on the rims. The spokes on each side are notched to cross each other, and the two sides are bolted together with wooden distance-pieces between. (Here again, all bolts were omitted from the model.)

The "cogs" or gear-teeth are shaped from wood—usually hornbeam, by the way— and are set in sockets in the rim-castings, wedges driven from the inside being used to secure them.

For the model cogs, deal was used, planed to 9/64 in. thick. A small jig was made to enable the slope of the teeth to be pared quickly, and each tooth to be cut off to the same length as the others.

One of the rim-sides having been cut from $\frac{1}{16}$-in. ply, and pinned to a board, the cogs were cemented in place with balsa spacers; a very tedious and exacting task. The other rim having been cemented on, and the spokes added, another tedious job was painting the spacers black without getting too much paint on the cogs! Fig. 20

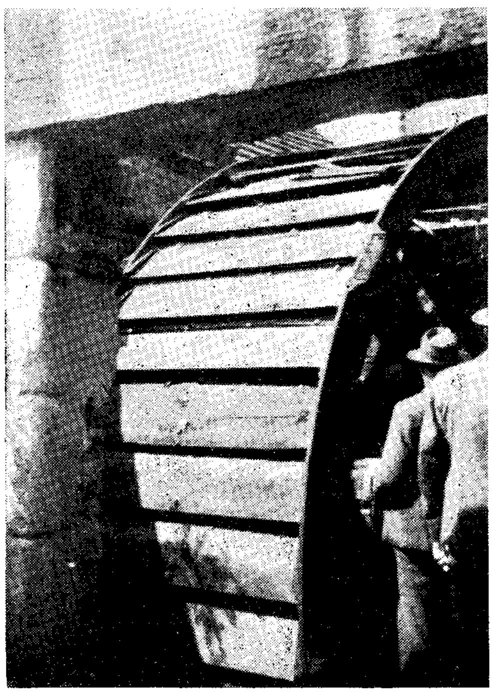


Fig. 17A. *A water-wheel which used to drive a set of tilt-hammers at the Abbeydale Works, Sheffield. This photograph was taken on the occasion of the Joint Summer Meeting, in June,* 1950, *of the Newcomen Society and the Sheffield Trades Historical Society*

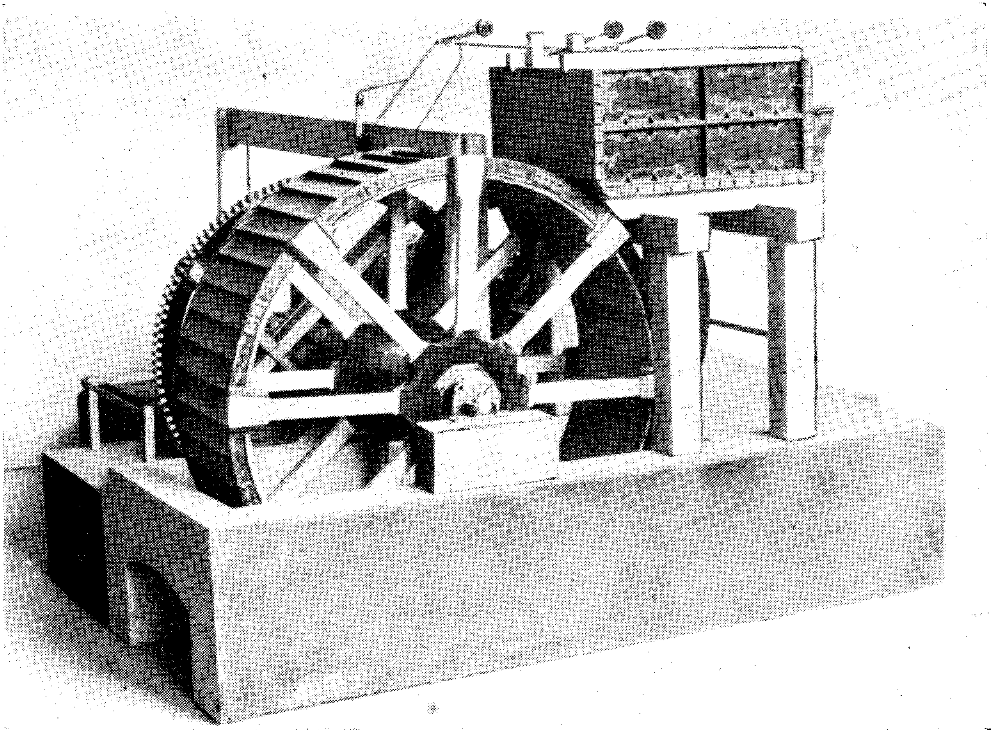


Fig. 18. The model from the water-wheel side

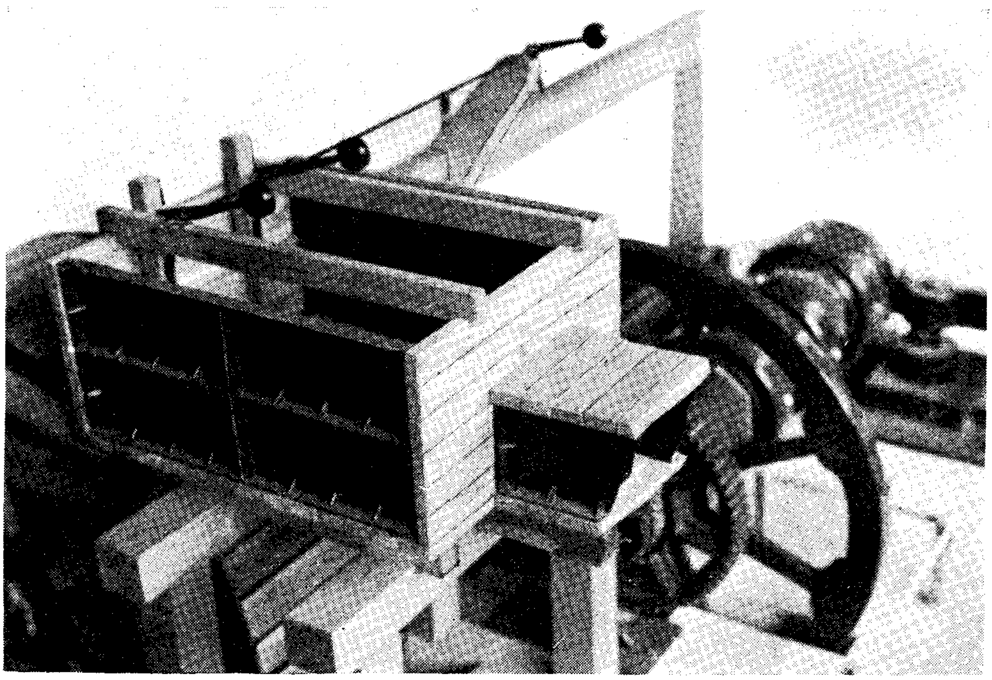


Fig. 19. Sluice assembly from above : the goit and its timber bearers are shown as if broken away

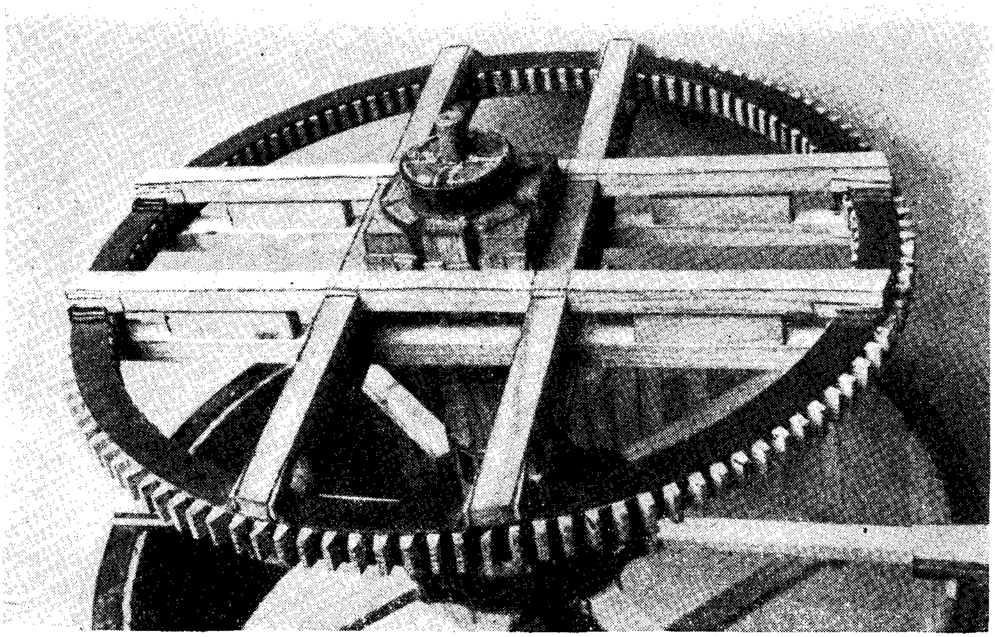


Fig. 20. *Close-up of the main cog-wheel of the model. This, too, is fixed to the wheel shaft with wedges*

shows the finished cog-wheel mounted on the shaft.

In the Abbeydale Works, the tilts are in a house, with the water-wheel outside. The level of the hammer-floor is below the ground, and so on the model the extension to the base was made higher than the rest of the base. Again in the prototype, the inside part of the sluice-operating mechanism is carried on one of the roof-beams—the rod actually passes out through the roof—and in the model a beam was mounted overhead to correspond.

An arch was made in the front of the wheel-pit to enable the imaginary water to run away, and the masonry was represented by painting on "Wallart"—a kind of modelling powder—mixed with poster-colour. This was lined with a modelling-tool before it set hard. The remaining horizontal surfaces of the base received the grey-paint-and-silver-sand treatment, and its remaining vertical surfaces were similarly treated with black paint and silver sand, which gives a very attractive black matt surface.

All metal parts of the model—real and make-believe—were painted black, and all wooden parts treated with "oak" oil-stain.

Since completion, the model has created interest—and, we believe, some education!—at three exhibitions. The first of these was at the Sheffield Festival of Education Exhibition in July, 1951, and the second at the "M.E." Exhibition in August. It was here that several people admitted to me that they had no previous knowledge of tilts; one of them at least had imagined that before the invention of the steam-hammer all forge-work had to be done by hand! The third exhibition was at a conversazione held by the Sheffield Trades Historical Society; this was probably the most exacting test, for the model was among men who have made a life study of this and kindred subjects. However, it is pleasing to note that it came through with flying colours.

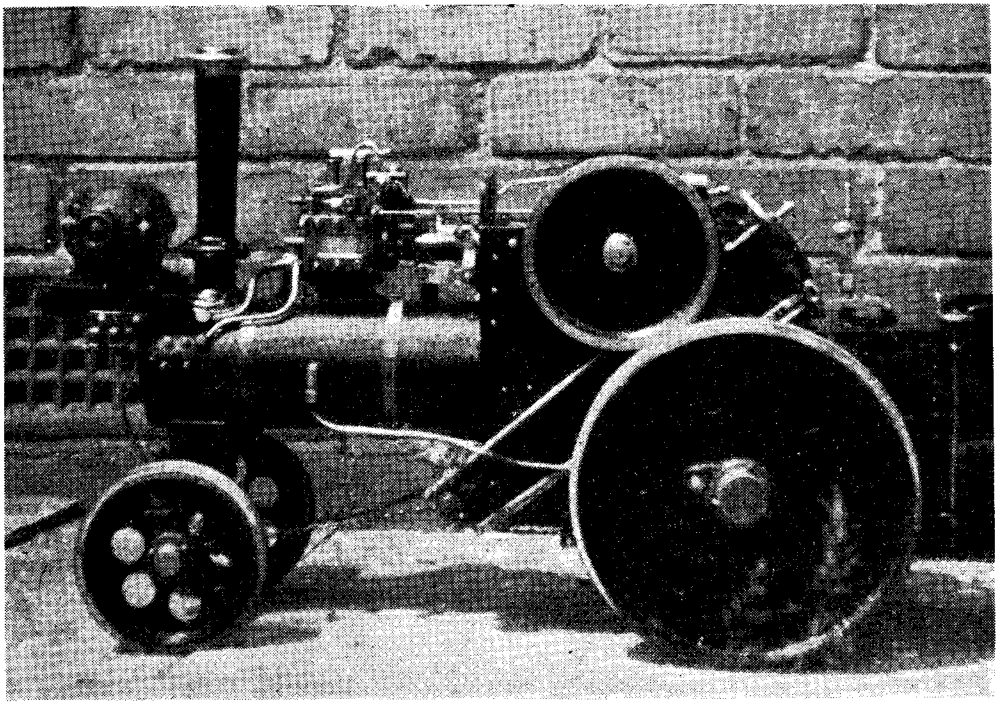
In conclusion, it should be stated that no claim is made that the model is entirely the work of schoolboys. Many of the more intricate parts were made by my colleague Mr. C. E. Sewell, and by myself. The construction was spread over several months, and although no record of the actual hours was kept, it must run into many hundreds.

Drilling Large Holes in Sheet Metal

Twist drills and thin sheet metal do not go well together, because of the tendency to pull in and buckle the metal, unless the cutting angles are modified or the drilling is done through clamping boards. Large holes can be cut cleanly and easily by simply using an ordinary carpenter's centre-bit—turned backwards! The spur will trace the outline of the circle, while the lip which clears wood chips in normal drilling will be kept clear of the surface. For soft thin metal the bit can be used as it is, but for harder or slightly thicker metal the back of the spur can be shaped to correct cutting angles, without impairing the efficiency of the bit for wood drilling when turned in the opposite direction.—P. W. BLANDFORD.

A Traction Engine Without Castings

by J. Cardwell



HAVING read THE MODEL ENGINEER for about 20 years and made sundry small models, it was decided to make a traction engine, about $1\frac{1}{2}$ in. scale.

A start was made on the boiler shell which is a 4-in. steel tube split and a throat plate welded in, the locomotive type boiler itself fits inside this and the space then stuffed with felt. Next came the hornplates of $\frac{1}{8}$-in. steel. After drilling for crankshaft and 2nd and 3rd shafts it was riveted to the boiler shell. The crankshaft bearings were made by brazing a piece of $\frac{1}{2}$-in. thick steel on to a $\frac{1}{8}$-in. plate to form a flange for riveting on to hornplates, afterwards fitting split caps and gunmetal bushes. The second shaft and back axle bearings were turned from bar with webs brazed on.

Next came the crankshaft, this was brazed up but warped in the heating, so another was made which turned out first-class.

Not wishing to use castings, the flywheel was built up. A ring of 1 in. $\times$ $\frac{5}{8}$ in. steel was bent up and the joint welded ; into this was pushed a round steel plate $\frac{1}{4}$ in. thick and bored out $1\frac{1}{2}$ in. to take the boss, the whole job was then brazed up at one heat. Afterwards it was machined up as a casting.

A start was then made on the road wheels. Thinking they were outside my skill, a rim was bent up out of 2 in. $\times$ $\frac{1}{8}$ in. steel and the centre was a $\frac{1}{8}$-in. plate brazed in, the hubs were cut pear-shape and riveted on and soldered. The result was a very strong wheel, rubber bands were obtained and fastened on with rubber cement.

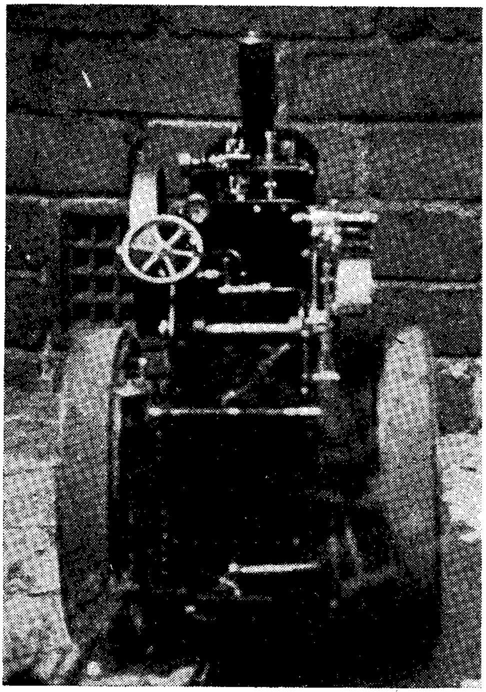
I have since made a set of prototype wheels, but have not yet fitted them. The cylinder was cut from the lug of a large eccentric off a locomotive, and is gunmetal. I soon made a mess of that, I bored, and drilled all the stud holes all right, but broke in the bore when drilling the steam ways to the safety-valves ; it is lucky there are two lugs on an eccentric and the second one turned out O.K. The ports are $\frac{1}{8}$ in. $\times$ $\frac{5}{8}$ in. and $\frac{1}{4}$ in. $\times$ $\frac{5}{8}$ in. A trunk guide was turned from steel bar and the valve-guide bracket brazed on. Drain valves were fitted to the cylinder with unions and $\frac{1}{8}$-in. drain pipes, the blower-valve is also screwed in the steam dome on the near side. The connecting-rod was cut from the solid and is fitted with split brasses and oil cup.

All the valve gear is cut from the solid and is potashed and fitted with silver-steel pins ; the eccentrics are turned from steel with gunmetal

straps $\frac{1}{4}$ in. wide.,

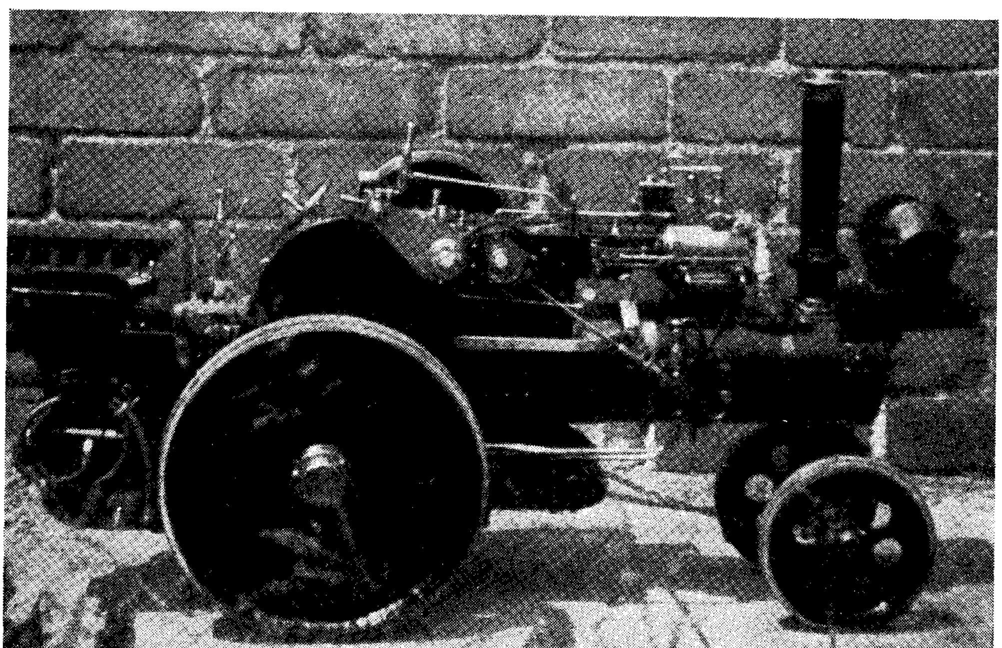
Next came the gears and here I wish to thank my father for all the trouble he took to produce the same. The blanks were flame-cut and the bosses welded in, afterwards turned and bored to size. The teeth were cut with home-made cutters and home-made dividing-head. The large gear has 120 teeth, and is 7 in. diameter.

The boiler is copper, 3 in. diameter and 13 in. long with a 5-in. firebox, it contains one $\frac{3}{4}$-in. superheater flue and seven $\frac{3}{8}$-in., a $\frac{1}{4}$-in. superheater is fitted. I have seen it in print that a traction does not need a superheater, but I agree with Mr. R. A. Briggs on this matter that they are as good as 30 lb. extra steam. The boiler was brazed and stayed with $\frac{3}{16}$-in.



copper tubes and tested to 200 lb. the safety-valves sets at 80 lb., a $\frac{3}{4}$-in. pressure gauge is fitted. A $\frac{3}{16}$-in. water gauge, a valve for the water lifter which works perfectly and a valve for the whistle. A $\frac{7}{16}$-in. bore hand pump and a $\frac{3}{8}$-in. bore engine pump with by-pass returning to bunker is fitted. The bunker is 18-gauge steel, flanged and the back riveted on. It contains a copper water tank and brass beading round the top.

The steering wheel was cut from a $\frac{1}{4}$-in. plate, the spokes cut with an Abrafile. The worm and wheel were cut for me by my father and are a beautiful job. The chain was made by winding $\frac{1}{16}$-in. welding wire round an oval nail and sawing up with a fine saw; when put together the joints were silver-



soldered. Shackles are fitted at the front end to take up slack.

A cylinder lubricator is fitted *a la* "L.B.S.C." and works perfectly; it delivers a little too much oil, also, it is geared down from the crankshaft 2-1.

The chimney was made by splitting 1 in. copper tube, closing in and brazing the joint, a brass cap was then turned and silver-soldered on. The base was made from a turned bush and two washers, being brazed together; the dynamo platform was riveted up from $\frac{1}{8}$-in. sheet and bolted to smokebox, the dynamo came off a cycle, but a fresh pulley was fitted, and the whole lot fitted in a case to represent a full-size machine. It is wired to a small switch-board on the side of smokebox and from that to the head lamp.

The first steam test was on a table fired with a blowlamp.

A grate and ashpan were made, the damper being worked from footplate.

After several steam tests and valve settings, it was washed with petrol and painted. The smokebox black, boiler and bunker maroon and all brass bright.

It was made in my spare time over about two years, with a break in which I made a lathe.

The engine will pull two men easily with 80 lb. steam, and steam 20 minutes with one firing. I have since obtained that splendid book *Traction Engines Worth Modelling*, by W. J. Hughes. I only wish I had obtained it sooner, as no drawings were used in the construction of my engine.

In passing I wish to thank my father and Mr. R. Heyworth, my friend, and sundry roller and traction drivers whom I have pestered with questions and who have taken such an interest in the model.

The dimensions are :—

Width over rear wheels 11 in.
Overall length 2 ft. $7\frac{1}{2}$ in.
Height $17\frac{1}{2}$ in.
Diameter of flywheel 6 in. $\times$ $\frac{3}{4}$ in.
Bore 1 in. stroke $1\frac{1}{2}$ in.
Working pressure 80 lb. per sq. in.

I wish to state that this is a free-lance model intended for hard work, which it does perfectly.

The photographs were taken after a run when the fire was dropped and the ashpan was not replaced, which gives the engine a bare look under the boiler.

A New Method of Rust Prevention

THE problem of preventing tools and equipment in home workshops becoming rusty is one which is constantly under discussion among our readers, especially at this season of the year, when rapid fluctuations of both temperature and humidity are encountered. Many and various are the methods which have been suggested by readers for dealing with this problem, and the effectiveness of these methods is equally varied, but we have lately been investigating the claims of an entirely new method of rust prevention, which has been developed by the research laboratories of the Royal Dutch-Shell group of companies. This method was referred to in a letter by Mr. A. M. Sabine, published in the "Practical Letters" column of our issue of December 20th last. It employs a new principle, entailing the use of an anti-corrosion chemical known as "V.P.I." (Vapour Phase Inhibitor) which, for convenience in use, can be coated on paper, and used as a wrapping for metal articles or simply kept in their close vicinity. The chemical is slightly volatile, and under ordinary temperatures, slowly vaporises and permeates the surrounding air, forming a completely non-corrosive local atmosphere, in which water vapour cannot combine with atmospheric oxygen to start the chemical reaction which produces rust. V.P.I. eliminates the necessity for coating metal surfaces with oils or other resistant films, or for using dehydrating chemicals. It neither reacts with, nor removes water or oxygen, and owing to its low volatility, is easily retained in enclosed or semi-enclosed spaces. One gramme of V.P.I. vapour is sufficient to saturate 16,000 cu. ft. of air at normal room temperature.

For the packaging of components in enclosed, but not necessarily air-tight, boxes or containers, V.P.I. coated paper will act effectively for periods up to four to five years before the chemical ceases to produce its protective vapour. Where any movement of air takes place, vaporisation is accelerated, and the time of effective protection is thus shortened. A sheet of coated paper kept in a tool drawer which may be opened two or three times a day will protect the tools for eighteen months to two years, and a paper or fabric cover for a small lathe, lined inside with a coated paper, and kept in place at all times when the lathe is not in use, may be considered as a safe protection against rust for about a year.

V.P.I. is extensively used for the protection of machinery and parts which have to be shipped long distances and encounter severe climatic conditions. It has obvious advantages over methods which entail the use of oils, fats and waxes, and it is the first really practical way of protecting parts which have to be available for use at any time. One point, however, on which caution is necessary is that V.P.I. is neutralised by acids already present in the atmosphere, or which may be produced by chemical action in paper or other wrappings when exposed to moisture. Any containers or packings, therefore, should be ascertained to be chemically inert.

The firms mentioned by our correspondent, Mr. Sabine, namely, Messrs. L. Stace Ltd., York Place, Swindon Road, Cheltenham, and R. A. Brand & Co. Ltd., Field House, Breams Buildings, Chancery Lane, E.C.4, are licensed to carry out the coating of V.P.I. paper in this country, and arrangements are now in hand for the supply of paper in quantities suitable for use in the home workshop, which will be marketed by Messrs. William Cook Ltd., 96a, Cultain Road, London, E.C.2.

IN THE WORKSHOP

by "Duplex"

No. 108.—Modifications to the Kerry Drilling Machine

THERE are two matters connected with the Kerry eight-speed drilling machine that somewhat detract from its otherwise excellent qualities. In the first place the back gear is excessively noisy, and, secondly, and perhaps more important, the method used for moving the motor and changing the driving belt from one pulley to another is not good.

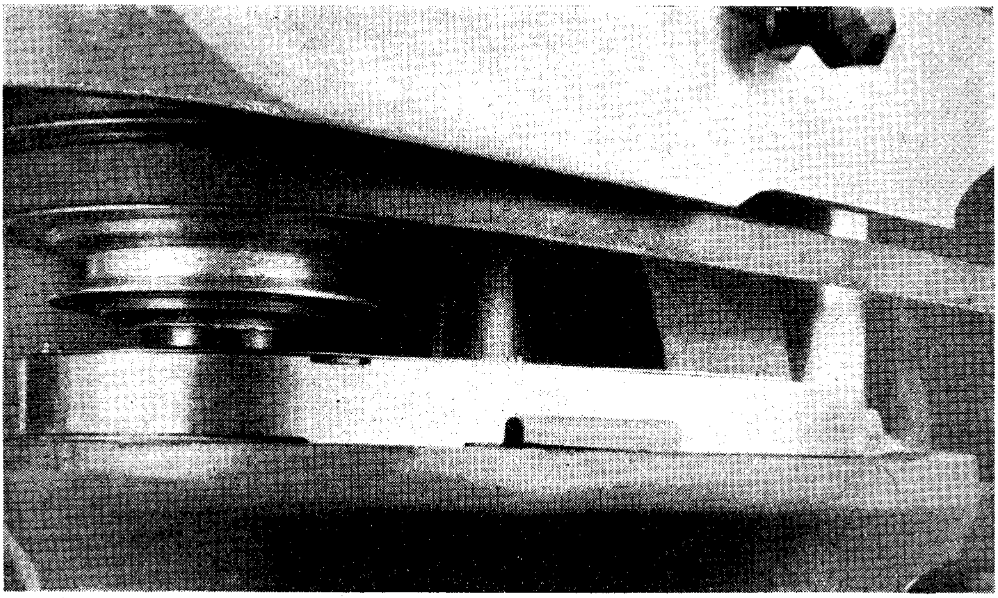


Fig. 1. The gearcase in place on the drilling machine

Those who have read the Test Report on the Kerry drilling machine will be conversant with the back gear arrangements, and will be aware that no provision is made for retaining lubricant on the teeth of the gears ; this lack of lubricant is, of course, the main reason for the noise. Owing to various factors in the construction of the machine, it is only possible to deal with the lower pair of gears in the back gear train. Fortunately, these gears are the pair that run at high speed.

The illustration, Fig. 1, shows that a metal gearcase has been fitted over the gear wheels in order to retain a supply of lubricant. A grease is used, because the various fittings that are mounted on the head of the drilling machine prevent the gearcase being made oil-tight. It has been found that Mobiloil Grease No. 2 is very suitable, as it tends to cling to the teeth of the gears and does not seep through the several places on the gearcase side-member that are cut away to clear obstructions.

The device is shown in exploded form in Fig. 2. The arrangement will be seen to consist of a side member *A*, preferably made from light alloy material so that the part can be formed easily, and two covering plates of sheet tin *B* and *C* that are fixed to the side member by No. 8 B.A. screws. The cover plates fit on to one another, the rebate taking the form of two metal strips riveted to one of the plates on either side of the joint. In order to stiffen the cover plates, channel section sheet tin members are soldered to the squared ends of each plate, as shown in the illustration.

As the device has only a light duty to perform, it has been found possible to hold the gearcase down to the drilling machine head by means of two screws only. In order to do this it is necessary to employ the two special fittings *D* and *E*, illustrated also in Fig. 3, and to make a pair of screws threaded $\frac{1}{4}$ in. B.S.F. but having 2 B.A. size hexagon heads. The reason for these special fittings is that the two $\frac{1}{4}$ in. B.S.F. bolts have the

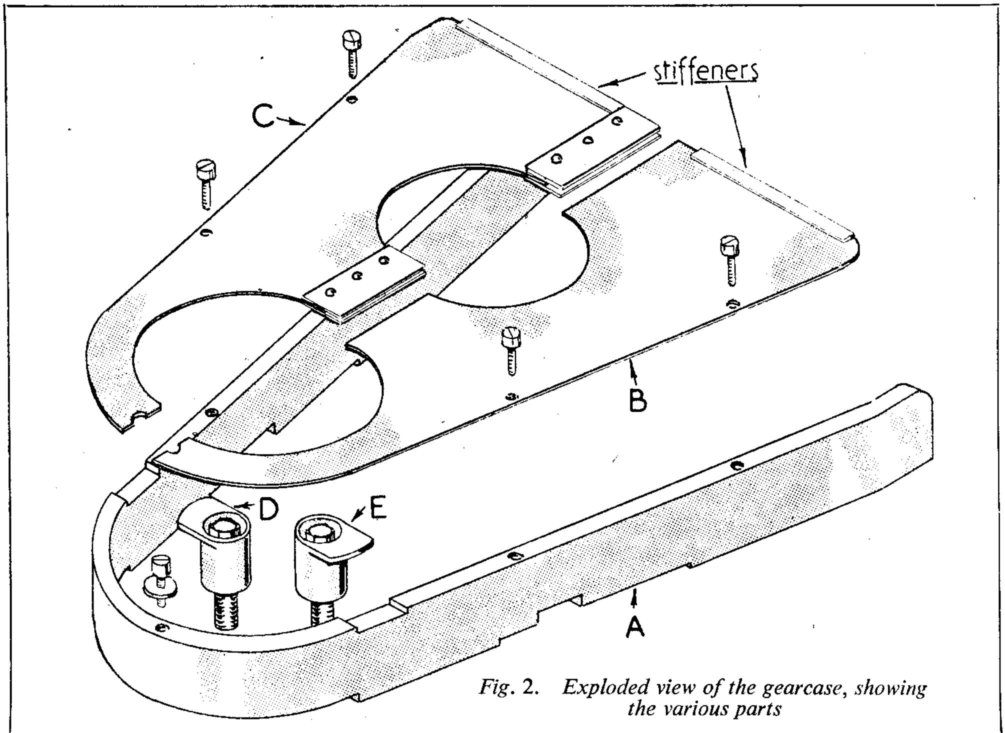
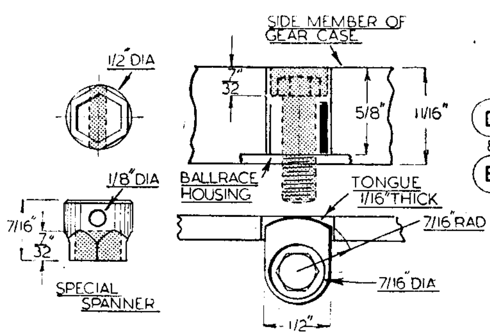


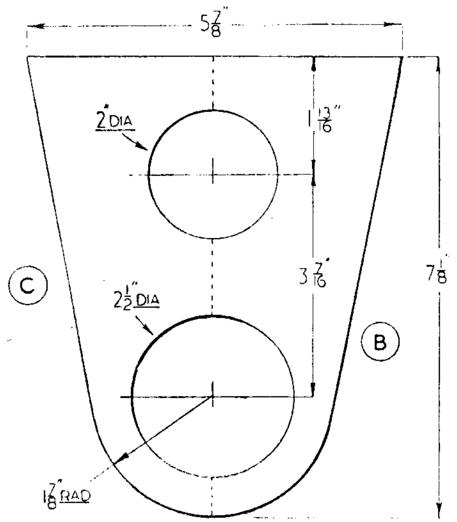
Fig. 2. Exploded view of the gearcase, showing the various parts

double duty of holding the lower bearing housing of the drilling machine pulley assembly in position, and at the same time, of securing the vertical member of the gearcase to the head of the drilling machine. As will be seen, the heads of the screws are in recesses formed in the special fittings. This provision is needed to keep the screw heads below the cover plates. A special short 2 B.A. box spanner must, therefore, be made to tighten these screws. Owing to the overhang of the pulley, no normal spanner can be used except initially, when an ordinary open-ended spanner may be employed. Details of the special spanner will be found in Fig. 3.

The first operation, when making the gearcase, is to bend the vertical member to shape. After



Above—Fig. 3. Details of the fittings " D " and " E," and the special short box spanner



Right—Fig. 4. Details for marking-out the cover-plates

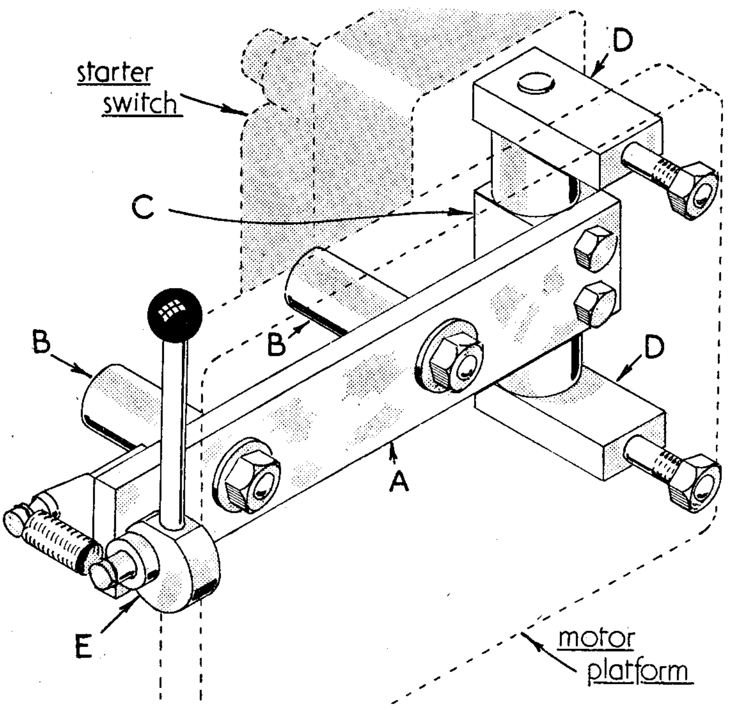


Fig. 5. Exploded view of the modified motor mounting

this has been done the several relieved portions seen in the illustration, Fig. 2, can be formed by filing away any unwanted material. This part of the work should be carried out with as much care as possible so as to make a sound joint between the vertical member and the upper surface of the drilling machine head.

As soon as this part of the work has been completed satisfactorily the two special bolts and the clamp fittings, illustrated in Fig. 3, may be made and fitted. It will be as well to make a check of the overall dimensions of the clamps in order to ensure that, when the $\frac{1}{4}$ in. B.S.F. screws are firmly tightened, both the lower bearing housing of the pulley assembly and the vertical member of the gearcase are simultaneously held securely. Nothing need be said in relation to

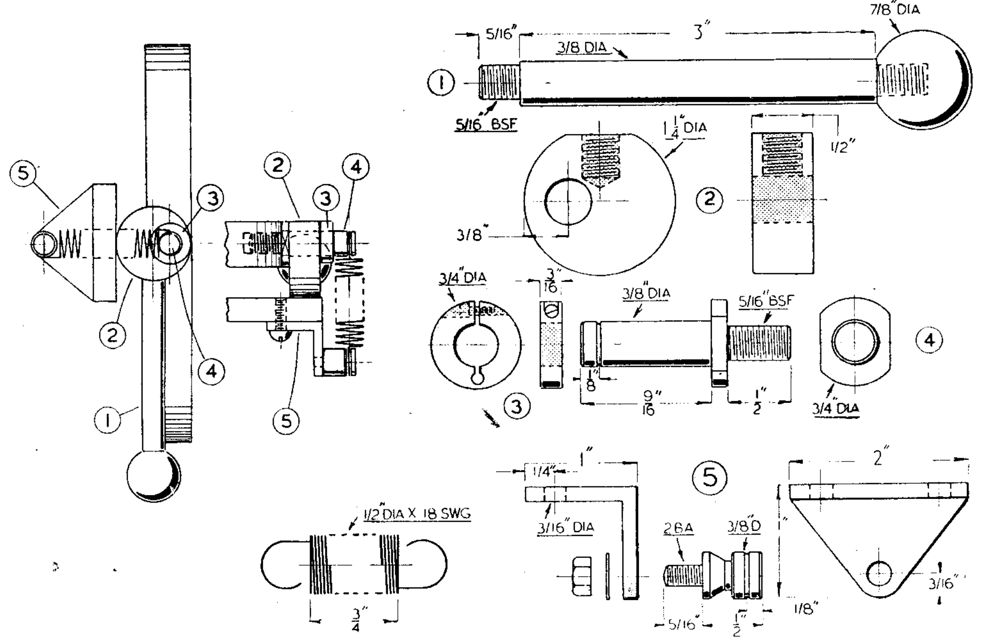


Fig. 6. The belt tensioning device and details of the component parts

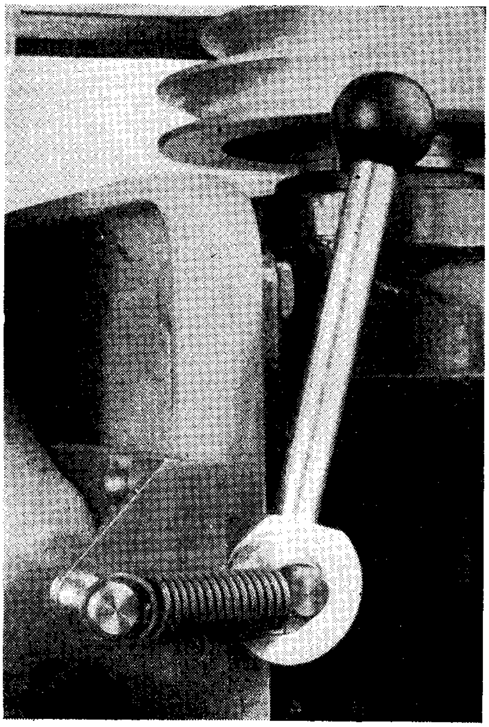


Fig. 7. The belt tensioning device in place

the making of special bolts, for they are straightforward work. The clamp fittings are also very easy to make and are formed, in the first place, by machining a shouldered distance-piece, then filing away surplus metal from the shoulder or flange in order to form a clamping lug. It will be observed that, in order to clear the cover of the gearcase, the head of the screw lies in a recess formed in the clamping-piece.

After these parts have been made, and the vertical member of the case has been fitted in place, the cover plates may be made. Dimensions for these components are given in the illustration, Fig. 4. However, before the work is started, a check should be made to ensure that the cover conforms to the curvature of the vertical member *A* when in place.

The work is first marked out according to the drawing. A washer cutter is then used to cut out the two large holes that allow the covers, when in position, to clear the pulley and the spindle of the back-gear. When these holes have been formed, and their edges have been filed smooth, the cover is cut in half by shearing carefully along the scribed centre-line.

It only remains to cut out and rivet on the strips of material that form the rebate for the joint, and to solder the strengthening pieces in place.

The covers may now be fixed to the vertical member and any projecting edges filed flush. When this operation has been completed satisfactorily, the finished gearcase can be assembled on the drilling machine.

No special filling hole for introducing lubricant

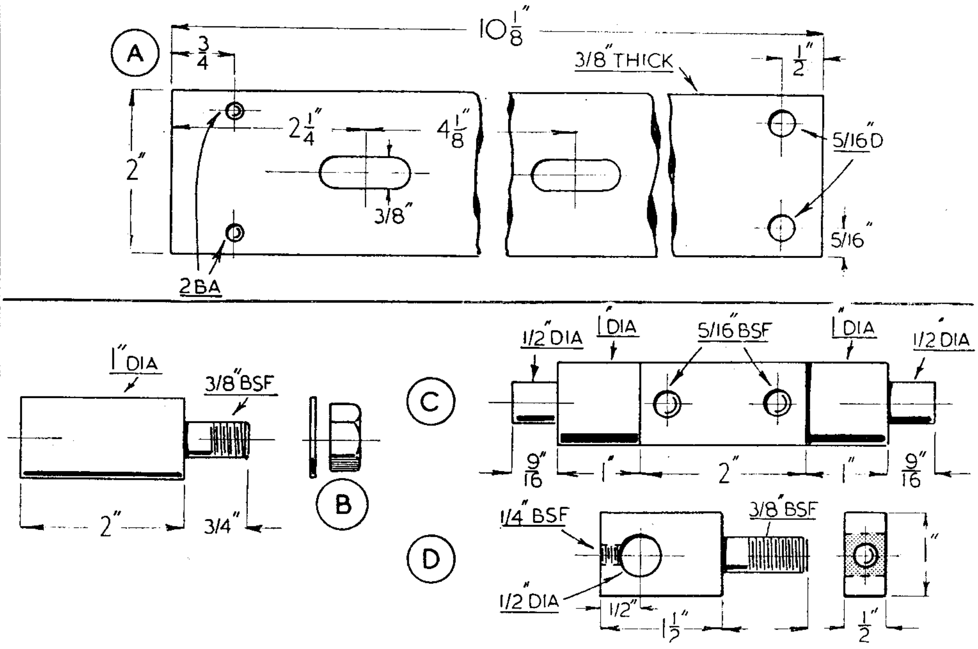


Fig. 8. Details of the component parts of the modified motor mounting

has been provided in the cover. It will be found that the opening at the large end of the case is quite adequate for this purpose.

Modifications to the Mounting of the Driving Motor

Experience with the Kerry drilling machine has shown that the method used for mounting the driving motor makes a most awkward business of changing the belt from one step of the pulley to another. It is virtually impossible to remove the belt except by springing it over the pulleys, a practice that all reputable manufacturers of V-belts roundly condemn ; moreover, the whole operation is clumsy and time wasting. In order to improve on these conditions, the device illustrated in Fig. 5 was made. It will be seen that this form of mounting consists of a base *A*, secured to the head of the drilling machine by two spigots *B* that fit in machined holes ; this base is provided with a hinge-piece *C* working in two eyes *D* affixed to the original cast-iron motor platform.

Movement of the motor is controlled by the lever and eccentric device *E*. This mechanism is also depicted in Fig. 6. When the lever is pointing downwards the belt is correctly tensioned ; moving the lever so that the knob points vertically, as seen in the illustration, Fig. 5, allows the belt to be picked off the pulleys with ease and moved from one step to another. The cast-iron motor platform has two $\frac{1}{4}$ in. clearance holes drilled in it in order to accommodate the starter switch. These holes are enlarged to $\frac{3}{8}$ in. dia. to take the two hinge eyes *D*. The starter switch is subsequently attached to the head of these hinge eyes by means of two B.S.F. $\frac{1}{4}$ in. screws.

It is necessary to make one further minor modification to the cast-iron motor platform. In this part there are a pair of tapped holes for the two spigots that originally held the platform to the drilling machine head. These holes must be enlarged to clear the $\frac{3}{8}$ in. B.S.F. nuts that secure the spigots to the new base *A*, preferably by filing. In addition, a hole must be drilled and tapped $\frac{5}{16}$ in. B.S.F. in the edge of the platform in order to accommodate the shouldered pin for the eccentric member of the belt tensioning device.

This part of the work is best carried out with the platform secured to the lathe top-slide and packed to the correct height. It will then be possible to drill and tap the hole and also to spot-face the surrounding surface in order to provide a square seating for the shouldered pin.

All the machine operations for marking the various parts are quite simple and require no comment. It will be observed that the $\frac{3}{8}$ in. dia. holes in the base part *A* are slotted. This is necessary in order to provide an adjustment for aligning the driving belt. The collar that serves to retain the eccentric upon its shaft is shown in the detailed illustration as being split and having a tensioning screw. This method of securing the part is to be preferred, but a 4 B.A. grub-screw set radially in a plain collar will serve quite well if a split collar is not needed.

PRACTICAL LETTERS

Old Boilers

DEAR SIR,—Having noticed Mr. W. A. Calder's letter, I am reminded that about three years ago it was my privilege to see the machinery at the well kept tannery in Station Road, Ashford, Kent.

I was amazed to find a small egg-end boiler still in use : in conjunction with a Cornish it was supplying steam for processing, and to a small very old-fashioned horizontal engine, driving pumps.

Fifty years ago there were two egg-end boilers working in this parish, one at the Castle farm, and one at Baker's Cross brewery.

Yours faithfully,

Cranbrook. J. M. RUSSELL.

Reply from a Critic

DEAR SIR,—With reference to my criticism of the connecting-rods of Mr. David Dobson's "Juliet," shown at the Leeds Exhibition, I merely pointed out that aluminium is *not* the material to use for connecting-rods. If this young man gives his rods a coat of aluminium, does he expect the judges, of whom at this show I had the honour to be one, to be psychic and to *divine* that steel is underneath ? Whatever his reason for painting them—and rust prevention is not a very good one—the fact remains that the rods should not even be the *colour* of aluminium. Nor, as my criticism further mentioned, should imitation flutes be painted on the rods ! As a matter of fact, judges would usually assume that the rods actually were steel, but how could one be certain ?

As for his fear that my words might influence his chance of winning a further prize, I can assure Mr. Dobson that the officials at any exhibition will use their own judgment when deciding the awards, and that his aluminium painted rods would do more towards losing him marks, as not being true to prototype, than would my statement.

I would also assure him that if he intends to keep on in competition work he will have to learn to take criticism as it comes—and some of it will be far more stringent than mine was ! But as a rule it will be meant to be friendly and helpful, and as such will be worth acting upon. Now that he has himself raised the point again, I would advise him to clean the paint off and to leave the rods plain steel, fluting them *properly* if so desired. A lanoline and petrol solution will solve his rust problem, or he can use one of the commercial protectors such as Shell Ensis fluid. But no aluminium paint, please !

In conclusion, I would like to reiterate my remark that this engine is a very creditable effort, and to wish Mr. Dobson well in his future modelling. If the promise shown in his "Juliet" materialises as I believe it will, he should go far.

Yours faithfully,

Sheffield. W. J. HUGHES.

Electronic Organs

DEAR SIR,—Through the medium of your columns I would like to approach your readers for information on the construction of electronic organs.

I am greatly interested in constructing an organ suitable for a small dance hall, but I am not familiar with the orthodox methods of operation.

Yours faithfully,

Goldthorpe. NORMAN SIDDONS.

A Latin Correction

DEAR SIR,—There is a typographical error in the Latin phrase I used in the article on my G.W.R. tank locomotive ("M.E.," November 29th, 1951) which I do not wish to have attributed to me!

The English I translated into Latin was "A word of wisdom." *Sapientia* is a noun of the First or A declension, so the Genitive case becomes *Sapientiae* which is what I wrote.

Yours faithfully,

Burton-on-Trent. (REV.) W. F. OAKLEY.

Adjusting Belt Tension

DEAR SIR,—M.L.7 lathe possessors will I hope be interested in the following tip for adjusting the belt tension from the built-in countershaft to the lathe headstock. This tension is governed by two hardened steel ¼-in. B.S.F. screws locked by a corresponding nut and extremely difficult indeed to get at to adjust. Mr. Sparey advocates removing the screws, softening, putting a screwcut in the end, rehardening and reassembling when it can be adjusted by slackening off the lock-nut and turning the screw with a screwdriver. I had to make this adjustment the other day in rather a hurry and shied at carrying out the above procedure on account of lack of time. The method I used was as follows :—

Slacken off the lock-nut two or three turns, put another ¼-in. B.S.F. nut on the screw and with a spanner on each nut, turn in opposite directions to lock both nuts together. It is now possible to make any adjustment on the tensioning screw by simply turning the outside nut with a spanner. When the correct tension is reached the nuts are separated with a spanner on each one, the second nut removed and the lock-nut tightened up. This is simply an adaption of the method used for fixing studs into castings and takes only a few seconds to perform.

Yours faithfully,

Ashton-upon-Lyne. N. KETTLE.

A Turret Toolpost Tip

DEAR SIR,—Having experienced a few uncomfortable cuts from tools projecting from the turret on the top-slide of my small lathe, the following simple remedy was arranged.

The tool bits not in use during the cutting operation are simply kept covered by short lengths of copper tube, each tube just a little longer than the projecting bit.

As the turret is moved around and another tool bit comes into use, the copper tube is simply removed. This tip may save some others from annoying little accidents.

Yours faithfully,

Falmouth. HAROLD V. EDDY.

CLUB ANNOUNCEMENTS

The Southern Federation of Model Engineers

The Chichester Society, whose secretary, Mr. W. G. S. Pope, was the retiring chairman of the Federation, were hosts to the Federation for their annual meeting held on January 5th.

On arrival, delegates were welcomed by the Mayor of the City at the Council Chambers and photographs were taken.

Among other business, it was decided that the Federation outing this year should be to Chichester at the end of the summer, where a track day will be held, and that a scheme for the sale and exchange of blueprints, castings, tools, etc., between members of societies in the Federation be started.

The accounts for 1951 which showed a satisfactory balance were passed and a grant was made to the Basingstoke Society as a practical token of the Federation's sympathy with them in the loss of their workshop.

Mr. Thomas, chairman of the Totton & New Forest Society, was elected chairman for the ensuing year, and Mr. R. A. Read, of Salisbury, was appointed honorary secretary and treasurer on the resignation of Mr. Williamson.

After the meeting, delegates were entertained to tea by the Chichester Society.

Hon. Secretary and Treasurer: R. A. READ, 90, Woodside Road, Salisbury, Wilts.

City of Bradford Society of Model and Experimental Engineers

The 44th annual general meeting was held in Laycock's Rooms on January 3rd, 1952. A good turn-up of members enabled a very successful meeting to be held. The meeting was presided over by Mr. C. Forrest, the retiring president.

Mr. K. Moulson was unanimously returned as hon. treasurer and Mr. J. Scarth was returned as hon. secretary.

On February 7th we have a "bits and pieces" meeting and prizes will be presented to the members who, by vote, give the best talk for five minutes on either the "bit" they have brought along or any subject they care to speak about. February 21st we have Mr. T. B. Rose (president) speaking; his subject is to be "A Trip on Lagomie." Both meetings commence 7.30 p.m. at Laycock's Rooms.

Hon. Secretary: J. K. SCARTH, 30, Tyersal Avenue, Tyersal, Bradford.

The Model Engineers' Society (Northern Ireland)

All our activity during 1952 will be the building of our track at the Belfast Waterworks, Antrim Road, Belfast, and it will need all the co-operation of our members to make it a success.

Secretary: J. LAZENBATT, 73, Westland Bungalows, Belfast.

The Tees-side Society of Model and Experimental Engineers

On Tuesday evening, January 22nd, a talk was given to members by Mr. Wm. Redmayne, the society's publicity officer, his subject being concerned with the adaptation of *ex*-W.D. electrical instruments and apparatus. Several such instruments and items of apparatus were produced for demonstration.

Hon. Secretary: J. W. CARTER, 28, East Avenue, Billingham, Co. Durham.

Wigan Model Engineering Society

At the annual general meeting of the society held on January 19th, 1952, all the retiring officers were unanimously re-elected for 1952. This is now the eleventh time that Mr. C. H. Noble has been made president.

The reports showed that a wide variety of interests had been catered for in 1951 through the medium of lectures, visits, film shows and track days. The locomotive builders are hard at work and at least seven new locomotives are on the way. The society is looking forward to good meetings and companionship this year and cordially invites lone hands to join.

Hon. Secretary: TOM BANKS, 146, Hodges Street, Wigan.